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Saving Fuel Supplies for the War

THE Fuel Administrator, with full confidence that it is necessary to the war, has issued an order abruptly closing industries for five days and for nine following Mondays. There is no disposition or desire to haggle over the question of his legal authority. At war, the industries patriotically comply with wishes or orders of the constituted authorities. Production is stopped, employees take enforced holidays. These are the surface facts that we see. What we do not know, because in war time all facts cannot be public, is the underlying condition which led Dr. Garfield to catapult this requirement into the intensified industrial activity of the nation. Part of it he has told, and no loyal man will raise a dissenting whisper against the explanation that coal must be provided for ocean steamships held in harbors by lack of fuel. Their needs are a first call.

In addition to this vital emergency of coaling the ships is the domestic railroad tangle, made far more serious by a succession of blizzards and zero temperatures in congested traffic districts. Until railroad and terminal are restored to normal flexibility we shall get 50 per cent result or less out of 100 per cent effort. If the arrest of industry order leads to a large degree of improvement in freight handling, it will be a wholesome return, well worth the sacrifice it costs. Let us pin hope to the prospect that raw materials and manufactured products will have better railroad transportation after the "workless" days are over.

With central stations, of course, the effect of the order is immediate. Filling their function as public utilities, they have no alternative but to continue to put energy on the lines, though generating in smaller volume. Compliance with the order is the duty of consumers and power will be cut off wherever violations are seen. The restriction upon manufacturing industries with its instant curtailment of power consumption automatically brings fuel saving, which is the paramount thing. It also cuts revenue, gross and net, of the electric utilities. How great a saving of coal will follow cannot be determined from the experience of any one company, it varies so widely with the load and the proportion of essential war industries. As indispensable industries, essential in both war activities and to the great body of consumers in other industries and in homes, public utilities are placed high on the list of those to whom more adequate coal supply is promised by the regulation. Many of them are suffering keenly from coal shortage, and to these relief is welcome.

The Fuel Administration has evidently abandoned, at any rate for the time being, all thought of discriminating sharply between essential and non-essential industries. It is clear that a more drastic program, promising direct relief without delay, was regarded as necessary. Any measures which are in the national interest will be accepted patriotically. But, looking to the future, may we venture to recall to the Fuel Administrator that the energies of his organization, from first to last, have been directed more to cutting down consumption than to any other policy? There is another line of action which we respectfully submit for the thoughtful examination of the authorities. It is that less attention be paid to restriction of coal consumption, that more attention be given to stimulating coal production. Cannot the national Fuel Administration, with all of its great influence and power, turn earnest, resourceful vigor in 1918 to the question of stimulating production of coal; in brief, concentrate upon coal production, making that the major note in its policy and letting the limitation of consumption fall back to a secondary place?

A Genuine High-Pressure Steam Plant

ELSEWHERE in this issue is published an article on the design and construction of one of the first central generating stations in this country to operate at 300 lb. (21.1 kg.) steam pressure. This plant is feeding energy into the transmission system of the Public Service Company of Northern Illinois. It is one of about thirteen plants which are now serving thirteen counties. As it grows from its present rating of 10,000 kw. to its ultimate rating of 60,000 kw. it will no doubt absorb a greater and greater portion of the system load.

The efficiency of a plant with such a future facing it is a vital consideration, and so the efficiency of this Joliet plant is a matter of much interest. Tests to determine just how cheaply the plant will produce energy have not yet been made. The increase in efficiency gained by the high steam pressure is, therefore, as yet open only to estimate. It is considered quite probable, however, that the over-all boiler efficiency under operating conditions may exceed 80 per cent, a gain of 5 per cent over the best average practice to-day. In the turbine the 100-lb. (7-kg.) additional pressure should theoretically make possible a further gain of between 6 per cent and 7 per cent, giving a steam consumption that will compare favorably with that of the largest unit now in service. So, judging from facts that are known and allowing for the usual discrepancy between theoretical and obtainable economies, it does not seem

unreasonable to expect this new plant to produce a kilowatt-hour on 18,000 B.t.u.

Against this increase in economy must be charged the additional investment. It has been estimated that boilers for this high pressure cost about 20 per cent more than those designed for pressures close to 200 lb. (14.1 kg.). The increased cost of the turbo-generator was probably not so great as this. Owing to the small diameters, the piping valves and fittings are probably no more expensive than for pressure around 200 lb. An analysis of actual figures should show a net advantage to the plant well worth while. The final answer as to whether high steam pressure pays will probably be most easily obtained by watching for the advent of more plants of this general design after the engineers have had an opportunity to observe this plant in service.

In addition to operating at high pressure, this plant is one of the first to reach an operating steam temperature around 650 deg. At the Buffalo General Electric plant the steam temperature is 689 deg., obtained from a steam pressure of 275 lb. (19.3 kg.). In the present case the superheat is less by 50 deg., but the pressure is greater, being 300 lb. (21.1 kg.) at the turbine and enough higher at the boiler to insure the above density. It is probable that the boiler pressure will approximate 325 lb. (22.9 kg.), the design still allowing an additional 25 lb. (1.75 kg.).

There appears to be some difference of opinion as to the choice of pressure or superheat in making up the total steam temperature. Theoretically the advantage is on the side of higher pressures, but here mechanical difficulties place restrictions. To obtain a temperature range such as exists at Joliet a compromise is necessary. Pressure up to the present mechanical limits is employed, and the superheat to increase the initial temperature and add to the efficiency is used. Other factors influencing the degree of superheat are steam density and condensation during expansion. Superheat reduces the density and lessens friction. It also tends to prevent liquefaction in the turbine and should increase with the pressure. It is evident, then, that pressure and superheat must go hand in hand, the ratio to be determined by existing conditions and the results obtained from practice.

While little trouble is expected in the turbine, as up to a certain point it is merely a case of using heavier construction at the first stage and perhaps additional stages to cover the wider range, it is different with boilers and fittings. At Joliet the limit in pressure has been reached for the standard design of large boiler. Experimental work is being conducted to develop boilers for the higher pressures, but some time must naturally elapse before any new design is ready for practical application.

While the arrangement of boilers and economizers at Joliet has been used for several years in some of the leading stations in Europe, it is new to this country, as is the use of the all-steel horizontal economizer. To withstand the high pressure steel is more reliable than cast iron, but more subject to corrosion from low-temperature flue gases. Galvanizing the tubes should neutralize this action.

The design of the unit calls for height in the building, but not so much as for the individual detached vertical-tube economizer placed in the same location. The above-ground basement is another factor adding to the height, but this is counterbalanced to some extent by small overhead bunker capacity, calling for no additional height and minimizing the steel requirements. One great advantage of this arrangement is the elimination of ash-handling equipment. Another feature is the economical use of floor space. With backs retreating to the rear of the bridge-wall, the boilers require less than 0.5 sq. ft. (0.046 sq. m.) per nominal horsepower based on 10 sq. ft. (0.92 sq. m.) of heating surface. Taken as a whole, the plant represents modern practice with such changes as are necessary to permit the use of high pressure.

Alternating-Current Networks

IN COMPARATIVELY few cases is a purely alternating-current distribution carried out with the same attention to detail which experience has proved necessary in direct-current service. Alternating-current apparatus was originally developed with the idea of providing for scattered service which could not efficiently be reached in any other way, with the result that the early alternating-current plants were worked out with house-to-house transformers of small size, with short secondaries and with no attention whatever to the finer points of efficient distribution at uniform voltage. As time has gone on one great plant after another has become a huge hodgepodge of alternating-current and direct-current practice, growing up without scientific adaptation of means to ends. That an extensive alternating-current distribution can be carried out on sound engineering lines has been over and over again proved, but many of the attempts which have been made have not met with entire success.

S. Bingham Hood's paper in the current issue gives a general view of the situation from the alternating-current standpoint, bringing to the front the necessary characteristics of successful alternating-current distribution. The fundamental principles underlying it are that the transformer should be regarded as the equivalent of a direct-current feeder and the primary network supplying the transformers should be regarded as the equivalent of a substation bus on the direct-current system. The advantage of comparatively extensive systems of secondary mains is almost self-evident. Such construction is necessary in order to get uniform distribution of voltage and insure reliable service in the case of a single transformer giving out, as well as the full advantage of the diversity factor in the regions supplied. Mr. Hood's preference is for ring mains in a secondary service system, each one including a suitable amount of territory and provided with transformer service enough to avert serious overloading in case one transformer should fail. As the transformer overload commonly allotted is about 50 per cent, no independent secondary system should be fed by less than three transformers, and preferably it should be fed by more. With such an arrangement the blowing of a fuse at one transformer will not seriously interfere with the service on its particular secondary mains. The additional recommendation is made that the units be fairly large; in other words, that the system should be organized on a considerable scale. The object of this is obvious from the better characteristics of the bigger transformers and the more stable load obtained where a large number

of consumers are supplied from a single set of mains. How far these separate ring secondaries should be capable of interconnection is a matter which depends on local conditions.

Mr. Hood calls particular attention to the fact that proper cut-out equipment for secondaries of considerable output is not readily obtained. This is a lack which should be remedied. In fact, until quite recently proper primary cut-outs for the primary system were difficult to find; but this situation has been already remedied. Mr. Hood's preference is strongly for a primary network feeding the various groups of secondary networks. All that applies to the advantages of network connection on the secondary side also applies on the primary side, with the difference that still further care must be taken with respect to the interconnection of the primary network so that one fault may not involve a serious amount of territory. Provision must also be made for cutting out sections of the primary network in case, for instance, a serious fire occurs in the territory served. This is perhaps the most notable difference between alternating-current and direct-current network service. With the former it is imperative that the overhead high-tension wires should promptly be segregated in case of fire. In the latter the low-tension feeders and mains are very generally underground and do not constitute a serious danger in any event. A proper system of automatic cut-outs for use on the primary network is greatly to be desired and has not as yet been very thoroughly developed.

How far a system initially three-phase should be split up into the single-phase components, worked either two-wire or three-wire, is not easy to predict. Much will depend on the relative amounts of lighting and power service to be utilized within a given region. The logical arrangement for the preservation of uniform voltage and convenient distribution would seem to be the continuation of the three-phase network rather than extensive splitting into single-phase groups. No hard-and-fast rule can be drawn in the matter, however, since the local conditions must inevitably be taken into consideration. In short, the alternating-current network, like any other, must be laid out with the utmost care respecting the conditions of present and future demand.

The comprehensive general principle, however, that the transformer is a feeder to the low-tension network and must be treated as such is the basis from which network design must start. No two stations will present quite the same situation with respect to their supply lines on an alternating-current system, any more than they do on a direct-current system. The fundamental factor, however, is that with anything like the same care spent in alternating-current design that has been employed for years in direct-current design a wonderfully flexible, efficient and reliable organization of the supply can be effected. The earlier direct-current stations were driven to extreme care by the imperative necessity of doing fairly efficient work at low voltage over considerable distances. Free from this particular requirement, the alternating-current systems have generally received much less attention than they deserve. Hence the old commercial struggle between alternating current and direct current has not had the opportunity entirely to die out in its detailed influence, despite the fact that the larger part of every great supply station must be, and is even to-day, operated on alternating current.

Electrical Properties of Vulcanized Fiber

ONE of the well-known insulating substances used at the present time is vulcanized fiber. It is tough, strong, easily drilled or formed, and can stand exposure without disintegrating. At the same time, unlike glass or porcelain, it is slightly elastic and it is not brittle. Such a substance has a large scope of application in the electrical field.

The results of a number of tests for dielectric strength in various thicknesses and qualities of vulcanized fiber are presented in this issue by William Eves, 3d. These tests show how complex a property dielectric strength is. One might at first thought suppose that if a slab of dielectric 1 mm. thick had a rupturing emf. of, say, 12 kv., a slab of similar material 2 mm. thick would have twice the rupturing emf., or about 24 kv. As a matter of fact, it would have perhaps less than 20 kv. It always happens with solid dielectrics that as the thickness of a slab increases the volts per millimeter diminish. Experiment shows, however, that if a number of thin slabs, with surfaces of tinfoil, are tightly superposed to form a thick slab with thin parallel metallic layers throughout, the diminution in dielectric strength with increasing thickness is much less. Apparently the forced distribution of parallel equipotential surfaces throughout the mass of the dielectric enables the slab to support the electric stress better, even although it is evident that the rupture of any component slab immediately short-circuits it throughout by the conductive action of its tinfoil surfaces.

With this acknowledged non-conformity of dielectric strength in slabs of different thickness, it is evident that, in the presence of residual moisture or traces of chemical in the material, the effects of temperature upon the rupturing emf. of the material are likely to be different in different specimens, or even in the same specimen at different times. The results presented in the article point to such a generalization. However, if a suitable factor of safety is allowed to cover wide accidental variations, and if attention is given to mechanical and chemical specifications, there should be enough dielectric strength left available to meet practical requirements. The specifications mentioned in the article are instructive from this point of view.

The Coming Issues

THE nation-wide prominence drawn to the coal crisis by the order of the Fuel Administrator gives special value to the series or articles on the coal problem of electric central-station companies, which will be continued in next week's issue of the ELECTRICAL WORLD. Another feature of the Feb. 2 issue will be the development of a new transmission-line formula and a chart which, used together, simplify transmission-line calculations without sacrificing their accuracy.

Corrective Steps for Our Coal Problem

Central-Station Companies Operating Steam Plants, Deeply Concerned Over the Critical Question of Coal Supply and Cost, Make Constructive Suggestions for Handling It—Views on Railroad Unification

ALTHOUGH the Fuel Administration has taken drastic action by closing industries to conserve fuel, the basic conditions are not improved by arrangements of this nature, designed to give only temporary relief. Central stations are looking and hoping for permanent improvement in the underlying conditions of coal supply and transportation; they believe that remedial measures are necessary in those directions and that temporary restriction of consumption alone will not give the desired results.

The question of whether companies are near to or far from coal-producing districts, the possibility of buying coal in the open market for part or all of the requirements, the number of railroad lines accessible and, in general, the railroad facilities depended on for getting coal affect the policy of steam electric central stations on the issue of coal supply. Therefore uniform corrective measures would not solve all problems of the companies reached in the survey made by the ELECTRICAL WORLD, although there is almost general agreement that improvement in transportation is vitally necessary.

A number of suggestions have been made and are published by the ELECTRICAL WORLD herewith. Some of them deal with such corrective steps as are now being worked out by the railroads under unified government control. They also point out emphatically the importance of conserving fuel by closing isolated plants and diverting their energy requirements to the more economical central station. The canvass indicates that the companies are in very close contact with the local and state fuel administrators in their localities. It is also clear that they are prudently looking beyond the immediate situation to introduce corrective steps when the easier summer-time conditions prevail.

Difficulties with Labor

The opportunity to overcome the unwillingness of labor in mines to continue to work steadily is discussed by one company. "Our experience is that one of the chief difficulties in the fuel situation is the failure of the miners themselves to work," says this company. "It appears to us that the railway companies have been doing all that they could in the matter of spotting cars at the mines and the operators are willing to turn out the coal, but with the present high scale of wages paid to miners they will not work more than three or four days out of a week; and, too, they have a custom of declaring holidays every time something unusual occurs in their communities."

Another company, which is not far from one great coal-producing area where miners are agitating for an increase, writes: "Should the government enforce an additional increase of wages to labor in this particular coal field, it is the consensus of opinion of the coal operators that it will be an error. They point out that the higher the wages miners receive in this territory the less the tonnage per man that is obtained."

An important interest sees encouraging promise of an increase of possibly 25 per cent in available coal production as a result of railroad co-ordination:

> The corrective steps that must be taken are being taken rapidly. The coal production of the country can be increased substantially, possibly as much as 25 per cent, by a steady, regular supply of empty coal cars to the coal mines and quick transportation from the mines when the cars are loaded. This problem will be partially met by the unification of control of the railroads under Mr. McAdoo and further as additional equipment can be added.
>
> In many coal fields there are not as many miners as there should be and an increased number of miners would naturally increase production, but not until the car supply has become equal to the possible output of the miners now at work. Of course equipment, both locomotives and cars, must be added just as rapidly as they can be supplied.
>
> There are many ways of economizing in the use of coal—by the elimination of uneconomical plants, substituting contral-station service where the consumption of coal may not be one-half so great for the same result; by the elimination of non-essential industries and consumers, and by general economy, particularly in the operation of the railroads as one system, where nine locomotives may be able to do the work previously done by ten or even more.

Belief in Effect of Railway Pool

Similarly, another company expresses faith in the helpful influence of railroad operating unification: "We believe the pooling of railway equipment by the various lines under the national operating board will relieve the shortage of cars and transportation facilities to a very great extent. The maximum relief will be obtained when the operating details are fully worked out under this plan, which will take a little time."

It is the unanimous opinion that the outlook as to coal supply for the rest of the present winter is shrouded in uncertainty. Conditions are indicated by the following:

> The coal situation, in order to take care of our business, is extremely acute, but the Fuel Administrator has ordered certain mines to supply us with coal, and by more or less frequent trips we are able to buy some spot and have managed to keep in pretty fair shape.
>
> We don't consider the outlook for the winter of 1917 and 1918 as being very much brighter; in fact, it may be even worse before it is better.
>
> At present the outlook for coal supply is not very sanguine. Our shipments of coal within the last ten days have been very unsatisfactory.
>
> The outlook for the winter of 1917-18 is not very promising, and practically all companies in the State are experiencing trouble in getting their coal supply and are compelled to accept any kind of coal that is obtainable, regardless of the quality. I believe all of the coal furnished is being furnished at government prices. However, the question of securing the coal is the serious problem, and it is a very difficult matter to locate where the trouble lies. A part of it, of course, is due to shortage of cars and transportation troubles. However, there also seems to be a shortage of coal, and operators claim that the labor condition is to blame for this.
>
> If we have a mild winter, the chances are we will get through all right; if we have a severe winter, tying up river and rail shipments, the chances are we will experience a shutdown of greater or less duration.

From one company the suggestion is received that

"the existing deficiency in coal in the consumers' premises is in a measure due to the fact that they have not realized that the demands for coal are greater than ever before and have not appreciated that in every cold snap the railroads do not have the ability to handle coal as in warm weather; that the retailers, particularly, have not put in a supply of coal during the months when transportation can be easily handled, on account of the lack of transportation during intense cold. In other words, I do not see why the retailer should not endeavor to get coal during months when the railroads can move the coal and urge the domestic users to put in a supply during the warm months. With a little foresight on the part of every one and a little less agitation by the press, I really feel the coal situation would be very much improved, particularly if the government would force the miners to work a reasonable number of hours a week."

A company which is convinced that, in its district at least, the railroads are not wholly responsible for the coal famine and sees definite hope of improvement, says:

The practice of conservation by the coal consumers and the substitution of other fuel where possible will greatly aid the government and relieve the pending shortage. With transportation facilities provided, coal production right at this time should be at its maximum. The transportation companies, however, are not entirely to blame for the coal shortage, as during the summer months, when coal is generally stored for winter use, the mines were working only two and three days out of the week, on account of shortage of coal-handling equipment. At this time the coal-handling equipment was being used for transporting lumber and other material for the construction of army cantonments. It is a condition that, by the consumers practicing the utmost economy and the replacement of coal by other fuel, will soon correct itself, even with the increased demand.

One source of confusion, admitted as such by both the Washington authorities and the great industries of the country, is the multiplicity of priority orders. Efforts to reduce these and thereby to make the priority orders more effective when they are issued are under serious consideration now. "In our opinion," writes one company to the ELECTRICAL WORLD, "the greatest corrective step that can be taken by the government is to control more systematically the enormous number of priority orders which are being issued to the railroads, which are handicapping very seriously the efficient movement of cars."

The question of price is regarded by some companies as constituting the factor which most demands corrective action. Officers of two of these write:

I do not believe the government can reduce the prices without bringing on a serious condition, owing to the fact of such a low reserve. I do believe, however, that next summer the demand for coal will slacken and the price will fall below the present government fixed prices. It may be possible, after a year's operation at the government's prices, that the Federal Trade Commission will be able to determine from records that profits are unduly large, and a slight reduction may come.

What I fear for the future is this: A large number of contracts for coal at high prices will expire March 31, 1918. It is likely that the government will not permit renewals of contract except at its price. This price, in my judgement, is hardly high enough to promote average production, let alone increased production. If conditions get worse, I fear even priority orders will not in many cases result in sufficient coal deliveries. Better co-operation is needed between the government coal producers and railroads.

Other suggestions received by the ELECTRICAL WORLD the acceptance of which will help to restore normal conditions of coal supply and demand are as follows:

Greater care should be taken in the mining and shipping of coal to reduce the amount of ash, thereby reducing the amount of material that has to be transported on the railroads as well as transported through the streets of the city for the disposal of ashes by teams.

I would suggest that all power stations store as much coal as possible during the summer months; that the pooling arrangement for railroads be put into effect, and that all consignments of coal be unloaded immediately upon arrival at destination, so as to prevent the blocking of terminal yards by reason of their being used by coal companies as storage places. I believe another important factor would be to compel the use of central-station power by the small power users wherever it is available.

The greatest conservation of coal that could be made, in my judgment, is by the isolated or block plants taking central-station service. In the aggregate this would be a great saving in the country.

[A continuation of this article, to be published next week, will deal with other vital phases of the critical coal situation.]

UNDER ANTE-WAR CONDITIONS COMPANIES KEPT LARGE RESERVE COAL SUPPLIES

Electrical Properties of Vulcanized Fiber

The Effect Exerted by Color, Thickness and Temperature on the Breakdown Value of This Material—Reasons for Performance Noted—Specifications

BY WILLIAM EVES, 3D

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CONSIDERABLE work has been done in the measurement of the electrical properties of vulcanized fiber, but not very much of the information that has been obtained on the subject has been collected. This is largely due to the fact that it is extremely difficult to compare values obtained by one experimenter with those obtained by another, because of the lack of standardization in testing methods.

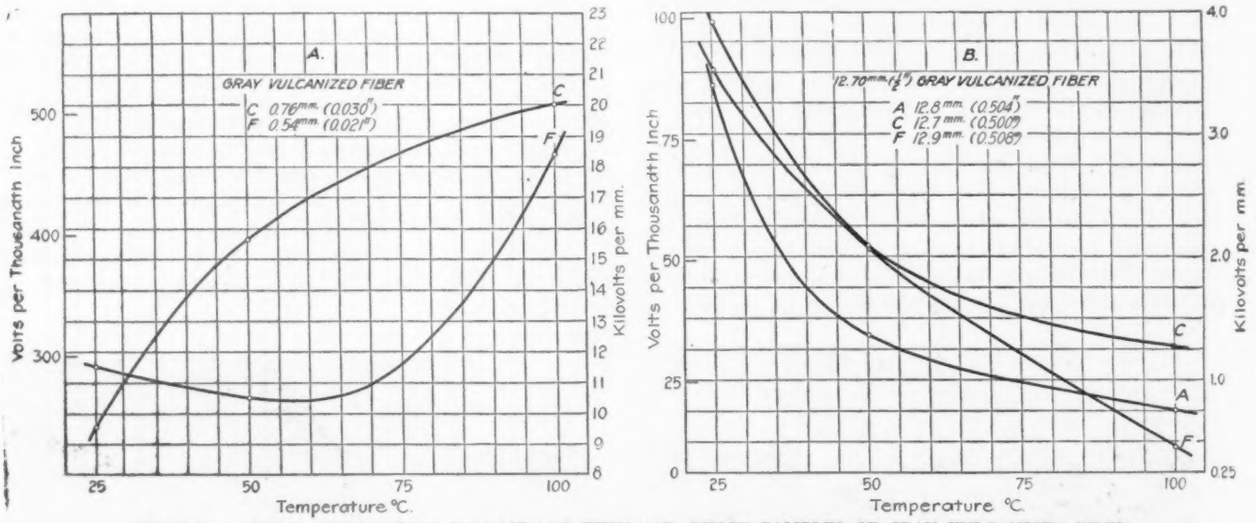
The specific resistance, surface resistance, specific inductive capacity and breakdown voltage, often called dielectric strength, are about the only electrical properties concerning which information is ever required by the user, and of these the breakdown voltage is by far the most important, as it is one factor which is considered in 98 per cent of the cases. Consideration will be paid here to this property only because the data available on the other three properties are so meager that their publication would not be warranted.

Breakdown Voltage

The breakdown voltage per unit of thickness of vulcanized fiber is a function of the thickness itself, the extent to which the gelatinization of the individual plies of paper has been carried, the temperature of the sample at time of test, and the color to some degree. Conditions of the material that are likely to affect the breakdown voltage are the quantity of chemical remaining in the fiber after its manufacture (which whenever present is extremely small), the moisture content, the homogeneity and density of the sample, and the physical shape of the sample.

Moisture to a certain degree is necessary for the life of vulcanized fiber. Zinc chloride is used as the gelatinizing agent in the manufacture of the fiber, and any that remains after the washing processes will be in solution in the natural moisture, because zinc chloride is a very deliquescent substance. This may happen in spots, and likewise any foreign material that would tend to reduce the breakdown voltage would naturally occur in a few places and possibly not at all in some samples. At these points leakage would occur between the electrodes of the testing set; local heating would result, reducing the resistance of the small amount of solution, and breakdown would occur before the true breakdown voltage of the fiber was reached.

As has been pointed out before in connection with tests of dielectrics, the method and conditions of the test will also affect the voltage at which the sample will break down. The shape of the electrodes, whether needle points, round-edge or flat-edge disks, or spheres, will affect the distribution of the electrostatic flux throughout the material, and the medium in which the terminals are immersed, oil or air, and the rate of application and the method of application of the voltage will determine the amount of heating due to corona loss, causing consequent drying and carbonization and premature breakdown. For these reasons due care must be taken that no peculiar conditions exist to distort the conclusions made and that a sufficient number of samples are taken to secure good average results.



CHARTS A AND B—BREAKDOWN VOLTAGES OF THIN AND THICK SAMPLES OF GRAY VULCANIZED FIBER

Curves Showing Effect of Temperature and Thickness

The variations of breakdown voltage with temperature for vulcanized fiber of various thicknesses and colors are illustrated by the accompanying curves. They were plotted from test data obtained at the Massachusetts Institute of Technology by Katzenstein and Burt. Each point on a curve represents the average of eight or nine tests on the same sample. Samples from four well-known manufacturers of vulcanized fiber were used in the investigation, and the results of those of approx-

imately the same thickness and color are compared. In all 4000 tests were made. They were all made with the same electrodes, and the voltage was increased at the constant rate of 1000 volts per second. At temperatures higher than room temperature the samples were prepared by heating in an oven for one hour for the thinner specimens and from four to five hours for the thicker.

Chart A, referring to gray fiber, shows an increase of approximately 80 per cent in breakdown voltage from 25 deg. C. to 100 deg. C., with a decrease in one case from 25 deg. C. to 50 deg. C. This dip in the curve probably would not occur in many samples of this thickness and cannot be explained without more knowledge of the chemical properties of the particular sample.

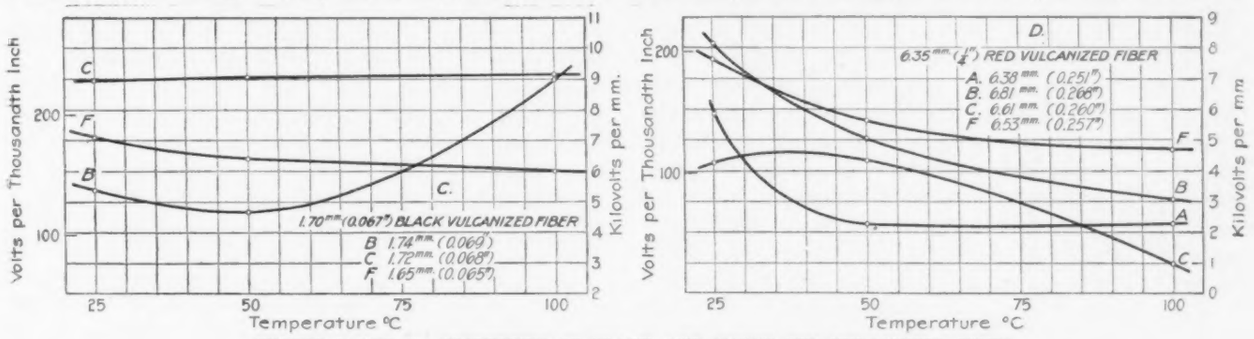
The results for thicker gray fiber, given in chart B, show an average decrease in the 25 deg. to 100 deg. temperature range of 77 per cent. Tests on pieces thicker than ½ in. (1.27 cm.) are not very interesting, because the voltage required to break down a sample of such thickness is greater than most commercial voltages.

A comparison of results on black fiber is given in chart C. Here again one sample shows a decrease at 50 deg. and a considerable increase at 100 deg. It is interesting to notice that the breakdown voltage of one of the other two samples slightly increases with the temperature, while the other slightly decreases. The average increase is 12 per cent. It is at the thickness of these samples that the turning point occurs. Greater thicknesses show a decrease in breakdown voltage with increase in temperature.

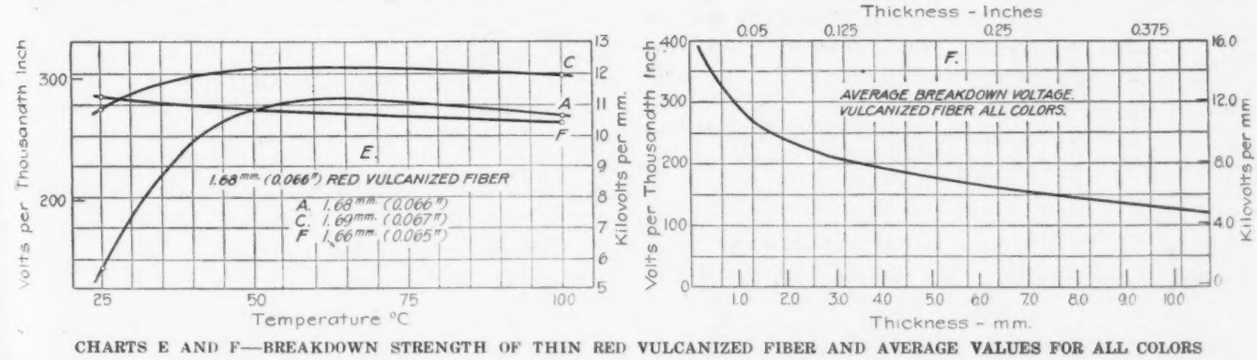
Chart D gives the results of tests with red fiber and is quite typical with the exception of one point at 50 deg. Here the average decrease in breakdown voltage in the range from 25 deg. to 100 deg. is 60 per cent.

According to chart E, relating to thinner red fiber than in chart D, the average increase in breakdown voltage from 25 deg. to 100 deg. is approximately 20 per cent, although the increase from 25 deg. to 50 deg. is slightly greater. This shows that the conditions tending to increase the breakdown voltage and those tending to decrease it about neutralize each other in the range from 50 deg. to 100 deg.

The most plausible theory for the change from an increasing variable with temperature to a decreasing variable, as the thickness increases, is that two conditions in the sample tend to offset each other. As stated before, fiber contains moisture to a certain extent and zinc chloride to an extremely small degree in solution. It is well known that the resistivity of solutions decreases with increase in temperature. On the other hand, fiber loses a certain amount of its contained moisture when it is heated, and the greater thicknesses do so much less rapidly than the lesser thicknesses, but not at all in proportion to the thickness. The thicker samples used in these tests were heated four or five times as long as the thin samples, but the thin samples would lose a far greater percentage of moisture in one hour than the thicker ones would lose in four or five hours. Hence in the case of the thinner samples the moisture content was probably less when tested at higher temperatures, the strength of the small amount of solution in the sample was greater and the resistivity greater. This was probably the controlling condition in the thinner samples, causing the breakdown voltage to be greater at higher temperature, while the temperature of the solution controlled the breakdown voltage at higher temperatures in the thicker samples.



CHARTS C AND D—PROPERTIES OF BLACK AND THICK RED VULCANIZED FIBER



CHARTS E AND F—BREAKDOWN STRENGTH OF THIN RED VULCANIZED FIBER AND AVERAGE VALUES FOR ALL COLORS

The results of these and many other tests made with the fiber of five large manufacturers have been averaged, and the composite results are shown in chart F. This curve gives values for room temperature only. The tests were made under all conditions and with all grades of fiber.

Gray fiber is made from paper of the natural color, with no coloring matter of any kind. Black contains a

small amount of lampblack or other coloring matter, and red is colored with a relatively large amount of various grades of oxide of iron. For this reason it would be expected that the colored fiber, and particularly red, would have a lower breakdown voltage than gray fiber. Although this is true in some cases, it is not always so. Here again other conditions affect the results.

Any loading material placed in the paper from which vulcanized fiber is made tends to interfere to some extent with the chemical treatment, and the result is a less homogeneous material. Coloring matter acts as a loading material and produces a slightly more "papery" fiber, which usually has a higher breakdown value because of the greater degree of lamination. Moreover, fiber is made from three grades of paper, which vary in the degree to which they are gelatinized by the chemical action. The paper from which ⅛-in. to ¾-in. (3.175-mm. to 19.05-mm.) fiber is made is treated to the greatest extent by the zinc chloride, and consequently a more homogeneous material, with low breakdown voltage, results. In a large number of cases the loading factor of red fiber is so much more pronounced than the tendency for the small amount of solution of oxide of iron to lower the breakdown voltage that the dielectric strength of red fiber will be higher than that of gray fiber. However, in other cases the reverse conditions exist, but the difference is so small as to be commercially negligible. Black fiber is usually between the red and gray grades and nearer the gray in its breakdown voltage.

Other Physical and Chemical Properties

As vulcanized fiber loses its normal amount of contained moisture its pliability decreases and finally it becomes brittle. This is caused either by application of a sustained temperature of 80 deg. to 100 deg. C. (176 deg. to 212 deg. Fahr.) or to higher temperatures up to 200 deg. C. (392 deg. Fahr.) for shorter periods of time. At this latter temperature charring commences. It has the following strengths in pounds per square inch: Tensile, 9000-13,000; compressive, 33,000-43,000; shearing, 9000-13,000.

Vulcanized fiber is not waterproof. It absorbs water to a certain degree, but is not injured by either hot or cold water, for it returns to its original dimensions and properties when dried. Most dilute acids and alkalis cause no other effect than the effect of water, but concentrated acids cause disintegration. However, organic solvents and all oils have absolutely no effect and are not absorbed in the slightest degree.

General Uses for Electrical Insulation

Although vulcanized fiber was first used in 1873 for axle washers and railway-car-journal dust guards, it has been more widely known in late years as an electrical insulator. It was early used in large quantities for magnet bobbins, coil insulation, cleats, armature wedges, insulating blocks, gears and handles, etc. Since the development of the automobile industry another large electrical insulation field has been opened. It is of service for insulated staples and cleats, straight and bent wire conduits, flanged bushings for use wherever a wire passes through body or frame, timer rings and other insulating rings, insulating washers, switch bars and bases, switch panelboards, fuse tubes, and in general where good machining and bending qualities are a necessity.

One of the largest uses of vulcanized fiber at the present time, either for electrical or mechanical purposes, is for railway signal insulation. The specifications for this application are quite severe. This is an instance where the material is subject to severe weather conditions and extreme mechanical strain, and yet the dielectric strength must be high even when it contains a fairly high percentage of moisture.

The Railway Signal Association's specifications require a specific gravity of 1.3 to 1.5; an absorption when immersed in water at 70 deg. Fahr. for twenty-four hours, not to exceed 45 per cent by weight for ⅛-in. (3.175 mm.) fiber, 30 per cent for 3/16-in. (4.76-mm.) fiber, and 26 per cent for ¼-in. (6.35-mm.) fiber; a tensile strength of 5000 lb. per sq. in. (351.5 kg. per sq. cm.), and a dielectric strength of 32 volts per 0.001 in. (0.025 mm.) for all thicknesses, under the application of voltage for one minute between disk electrodes 1 in. (2.54 cm.) in diameter. The specifications require further that the fiber shall withstand bending into a circle of a radius ten times the thickness without cracking or splitting.

BREAKDOWN VOLTAGES* OF SEVERAL THICKNESSES OF VULCANIZED FIBER

Thickness (In.)	Breakdown Value (Volts per Thousandth Inch)
1/32	225 to 425
1/16	150 to 300
⅛	125 to 275
¼	100 to 225
½	75 to 150

*Results higher than these have frequently been observed, but these limits will include the majority of cases.

The absorption and specific gravity are very important, first because of the service conditions, and second because the higher the specific gravity the more homogeneous the material is and the more easily is it fabricated, punched, bent and worked into shape. Moreover, fiber with high specific gravity will have a higher tensile strength and will resist shear to a greater degree under all conditions.

To fulfill these requirements the manufacturer must pay particular attention to the stock from which he makes the paper and to the conditions under which the fiber is run up. Tests must be made on each lot in order to make sure that no conditions have entered the manufacture which might harm the properties which are so important. It can be safely said that more care must be taken with fiber made for this purpose than for any other, because, as stated before, the more homogeneous vulcanized fiber is the lower the breakdown voltage is likely to be.

Conclusion

When the breakdown voltage per thousandth of an inch, the specific gravity and the cost per pound of vulcanized fiber are compared with the corresponding values for other insulating materials, it will be found that the commercial insulation value of vulcanized fiber is very high. In fact, it can be used in many cases where no other material will answer, when its ability to be machined with great accuracy and to be bent, punched and formed to shape is taken into account.

Joliet Plant a Step Toward Higher Steam Pressures

Second Installment of Article Deals in Detail with Method of Handling Coal and Supplying Feed Water, Features of Turbine, Condenser and Circulating-Water Arrangements

GENERAL features of the new high-pressure plant of the Public Service Company of Northern Illinois at Joliet, Ill., were outlined in the Jan. 19 issue of the ELECTRICAL WORLD, and interesting details were given regarding the boiler and economizer construction employed. This issue will dwell on the remaining mechanical equipment.

THE FEED-WATER SYSTEM

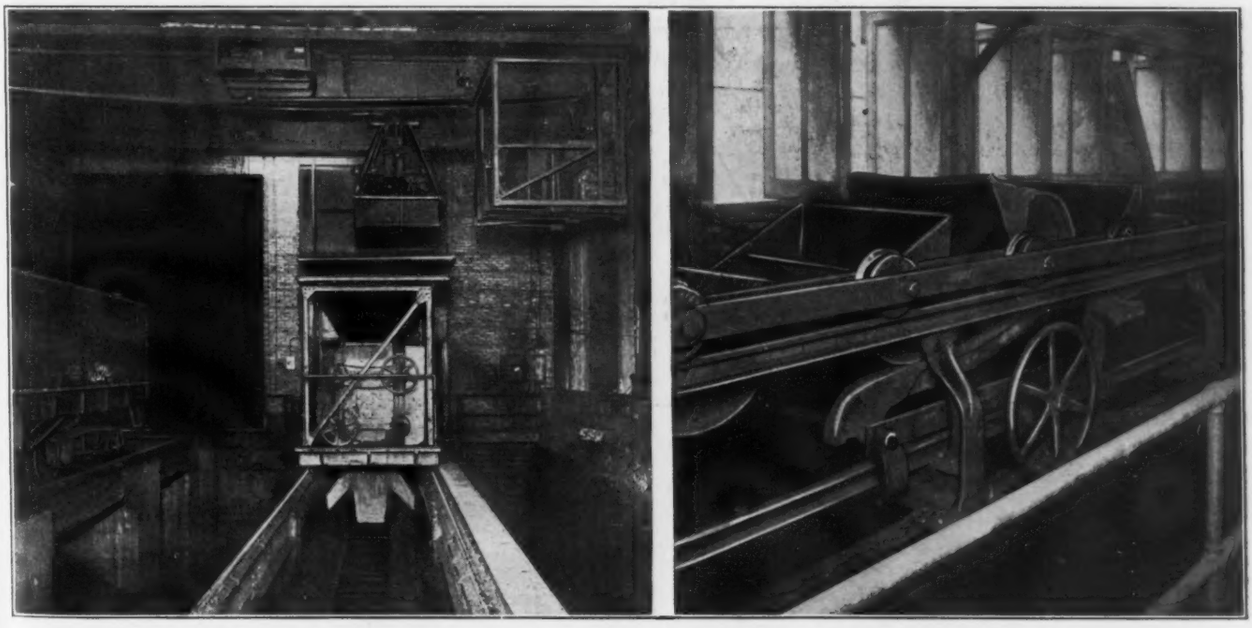
Feed water for the boilers is mainly condensate which has been delivered through a pre-heater at the top of the condenser containing 1000 sq. ft. (92.9 sq. m.) of surface to the heater by either one of duplicate motor-driven condensate pumps. The heater is of the open type, having capacity to serve the two boilers of the unit. Either of two four-stage turbine-driven centrifugal pumps designed to deliver 300 gal. (1135 l.) per minute against a head of 375 lb. to 400 lb. (26.4 to 28.1 kg.) feeds the water to the boilers. The turbines are rated at 126 hp. and operate under full boiler pressure, their output being controlled by pressure-regulating valves. The water passes through the economizer and enters the boiler at both ends of the cross-drum.

The make-up water comes from a fresh-water reservoir which collects the drips, heater overflow and other available condensed steam. Under float control it is also supplied with filtered service water. The house-service water supply is drawn from the condenser-intake tunnel by two 600-gal. (2271-l.) pumps, one driven by a turbine and the other by a motor. It is delivered to a service tank on the roof. From the pump discharge line several taps are taken off for transformer cooling and for various services where raw water can be used. Return water from the tank passes through duplicate pressure filters which are cross-connected and used alternately. Each has capacity to filter 150 gal. (567.8 l.) per minute. Upon leaving the filter the water supply divides, part going to cool bearings and to the lavatory system and the rest as needed to the hot-water reservoir. The vacuum on the main unit is utilized to draw the water from the reservoir into the condenser, the amount being regulated by a float in the heater. It is removed by the condensate pump in the usual way and delivered to the heater.

With the exhaust steam available the water temperature in the heater under average load conditions will range from 100 deg. to 120 deg. Fahr. To maintain the temperature within this range, a bleeder connection under thermostatic control has been made to the fourth stage of the turbine.

COAL-HANDLING SYSTEM

Coal for the plant, Illinois lump and screenings, is brought in over the company's siding from the Chicago & Alton tracks at Plaines, about ¾ mile (1.2 km.) distant. The company has its own locomotive and coal cars and a yard at the plant containing five tracks. No. 1 is a storage track running past the south side of the building, Nos. 2 and 4 are ash tracks serving the two rows of boilers, No. 3 is the coal track and No. 5 serves the turbine room. Between these tracks there is space to store about 10,000 tons (9,070 t.) of coal inside the power house. Track No. 3, centering on the firing aisle, leads into the boiler-room basement over a concrete pit capable of storing 800 tons (635.6 t.) of coal. By a four-motor traveling crane with a 2-yd.



FIGS. 1 AND 2—MOVABLE CRUSHER OVER CONVEYOR THAT DELIVERS COAL TO OVERHEAD BUNKERS, AND PORTION OF THE CONVEYOR, SHOWING BUCKETS IN PROCESS OF DUMPING CONTENTS

(1.8-m.) grab bucket the coal is unloaded into a four-roll traveling crusher driven by a 50-hp. induction motor which discharges to a bucket conveyor delivering into the overhead bunker. The latter has capacity to hold 450 tons (408 t.) or 112 tons (101 t.) per boiler. The bunker is made up of steel plates, concrete-lined, and is divided up into compartments with double chutes

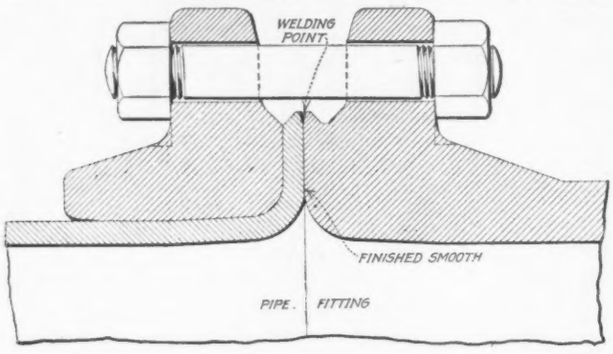


FIG. 3—SPECIAL HIGH-PRESSURE-WELDED JOINT FOR STEAM LINE

from each leading to the two stokers under their respective boiler.

Screenings are handled in the same way, with the exception that the rolls of the crusher are spread to allow the coal to pass through to the conveyor. On both sides of the crusher are by-pass chutes to the storage pit. The coal may be unloaded into the pit or onto the outdoor storage space. In the latter case a locomotive crane unloads the coal and loads it again when it is desired to remove it to the plant.

Under each boiler furnace are ash and fine coal hoppers. The former is lined with firebrick and is equipped with a sprinkling system to wet down the ashes. Through a manually operated sliding gate the ashes are passed directly to railway cars. Thus ash-handling apparatus is eliminated. Farther forward is the fine

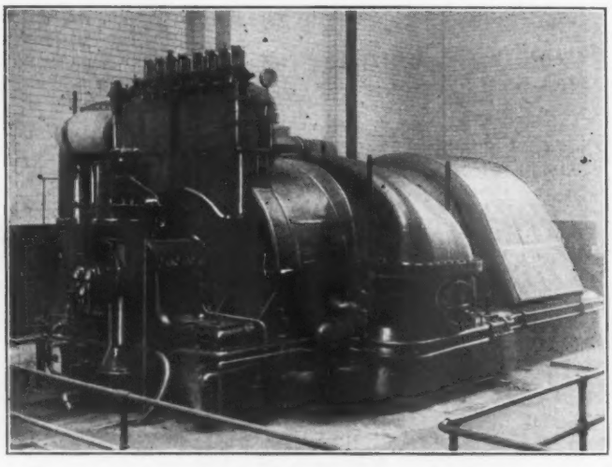


FIG. 4—ONE OF THE 10,000-KW. TURBO-GENERATORS DESIGNED FOR 300-LB. PRESSURE

coal hopper, which delivers its contents to the concrete storage pit. The outlet is controlled by a sliding gate operated from the boiler-room floor.

Steam Piping Features

All high-pressure piping is double extra strong, with fittings of cast or forged steel. On pipes above 4 in. (10.2 cm.) diameter a special welded joint is used. Numerous bends are employed in the piping to care for expansion. From each end of the superheater there is a steam outlet, the leads from superheaters being joined by special Y-fittings at the boiler-room wall. A 10-in. (25.4-cm.) pipe supplies the turbine.

IMPORTANT DATA OF JOLIET STATION BOILER ROOM

Boiler	B. & W. cross-drum water-tube
Steam making surface, sq. ft.	9,919
Active heating surface per kilowatt, sq. ft.	1.49
Pressure for which boilers are designed, lb. per sq. in.	350
Operating pressure, lb. per sq. in.	325
Superheat, deg. Fahr.	225
Steam temperature, deg. Fahr.	650
Capacity boiler, lb. steam per hour (normal and maximum)	60,000 to 94,000
Superheating surface, sq. ft.	3,130
Economizer	All-steel B. & W. horizontal
Stoker	B. & W. chain-grate
Active area stokers per boiler, sq. ft.	232
Ratio grate area to steam-making surface	1 to 43
Superheat surface (B. & W.), sq. ft.	3,100
Floor space occupied by boiler per 16 sq. ft. of heating surface	0.472
Floor space per 10 sq. ft. of heating surface	0.59
Height of boiler from floor to top of economizer, ft.	42
Induced-draft fan	Sturtevant multivane
Capacity of fan, cu. ft. gas per minute	75,000
Horsepower of motor	150
Stack	Unlined steel, one per boiler
Stack diameter, ft.	7
Height stack above grate, ft.	125
Coal	Illinois run-of-mine and screenings
Capacity bunker, tons	450
Concrete pit storage, tons	800
Yard storage, tons	10,000
Locomotive crane	Browning
Traveling crane	Whiting 2-yd. bucket, 150 tons per hour
Traveling crusher	Orton & Steinbrenner
Crusher capacity, tons per hour	125
Coal conveyor	Link Belt continuous bucket
Conveyor capacity, 45 ft. per minute, tons per hour	120
Boiler-feed pumps	Worthington, four-stage, 3-in. cent.
Horsepower of turbine drive	126
Pump capacity, gal. per minute against 375 lb. to 400 lb. head	300
Feed-water heaters	Warren Webster open type
Heater capacity, lb. per hour	150,000
Pressure filters, two per unit	New York "Jewel" Continental
Capacity each filter, gal. per minute	150
Service pumps, two, one turbine, one motor-driven, gal. per minute, each	600
Turbines	Horizontal Curtis, General Electric Company
Capacity, kw.	10,000
R.p.m.	1,800
Steam pressure, lb. gage	300
Superheat, deg. Fahr.	225
Floor space per kw., sq. ft.	0.0444
Condensers	Westinghouse two-pass
Surface in condenser, sq. ft.	20,000
Surface per kilowatt generator rating, sq. ft.	2
Pumps	
Circulating pump	Westinghouse centrifugal
Capacity of circulating pump, gal. per minute	18,000
Speed, r.p.m.	690-720
Drive, induction motor (also drives Le Blanc air pump), hp.	200
Air pump	Le Blanc, driven by circulating pump motor
Condensate pumps	Motor-driven centrifugal
Capacity, gal. per minute	360
Motor drive, hp.	25
Traveling screens	Link Belt
Drive, G. E. induction motor, hp.	5

The Turbine and Condenser Installation

The main generating units of the present installation are rated at 10,000 kw. at 80 per cent power factor. At the turbine the working pressure is 300-lb. (21.1-kg.)

gage. Over all the turbo-generator is 33.5 ft. (10.2 m.) long, 13.25 ft. (4.04 m.) wide and 12 ft. (3.7 m.) high, thus requiring a floor space of 0.0444 sq. ft. (0.0041 sq. m.) per kilowatt of rating. The turbine is served by a two-pass condenser containing 20,000 sq. ft. (1852 sq. m.) of surface.

Circulating water is supplied by a centrifugal pump having a capacity of 18,000 (68,136 l.) gal. per minute. In conjunction with a Le Blanc air pump, the circulating pump is driven by a 200-hp. slip-ring induction motor. Each condenser pump is rated at 360 gal. (1362 l.) of condensate per minute and is driven by a 25-hp. motor.

Cooling water for the condensers is drawn from the Desplaines River through a concrete tunnel and enters a forebay, where it first encounters an iron grid designed to keep back driftwood which may have escaped the log boom at the intake, and then passes through revolving screens. Each screen is driven by a 5-hp. induction motor through reduction gearing. Provision is made for swinging the screens in to a horizontal position for inspection or repairs. Water from slotted pipes is forced through the screens at high velocity to clean them, the debris draining into a trough leading to the discharge tunnel.

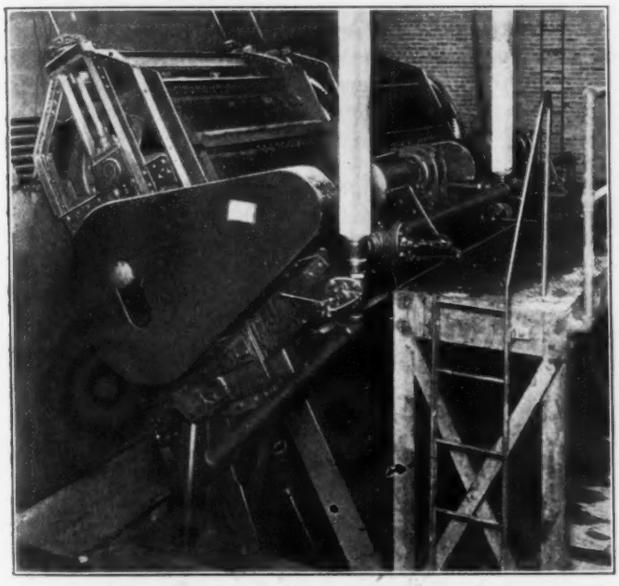


FIG. 5—TRAVELING SCREENS WHICH KEEP CONDENSING WATER FREE OF DÉBRIS

Back of the traveling screens are double sets of sectional stationary screens having ½-in. (1.3-cm.) mesh to catch fibrous material, small fish or débris of any character remaining in the water. For cleaning they are removed by a hand-operated beam trolley. The discharge tunnel extends along the top of the injection tunnel as far as the river side of the railway. Here it turns downstream and discharges into a swampy tract bordering on the river. From the turn in the main discharge tunnel an extension leads to the intake, so that warm water may be discharged there to reduce ice formation during the winter season. A sluicegate valve regulates the amount of water drawn off for this purpose.

The electrical features of this plant will be described in a later issue of the ELECTRICAL WORLD.

CHOOSING LIGHTING UNITS FOR INDUSTRIAL PLANTS

Scientific Illumination More Important Than Ever—Classification of the Principal Requirements for Lamps and Reflectors

BY DAVIS H. TUCK
Electrical Engineer Holophane Glass Company

EVEN in times of normal activities manufacturers have found that scientific illumination increased the efficiency of their plants by making possible (1) greater output, (2) better workmanship, (3) less spoilage, (4) fewer accidents, (5) less sickness, (6) reduced labor turnover, and (7) reduced overhead by twenty-four-hour utilization of equipment. These benefits are of greater importance than ever before because every manufacturer is confronted with increased costs of materials, shortage of labor, and the problem of increasing production without reducing the quality.

While expert advice is necessary to secure the best illumination, owing to the different requirements in different places, observing the following suggestions will bring better results than not having consulting advice at all.

THE LAMP

Efficiency.—The lamp should give the maximum number of lumens (light flux) per watt.

Life.—The life of a lamp is its economic life and not the period which elapses from the time it enters service until it fails. The efficiency (lumens per watt) of a lamp falls off with use until finally a point is reached where the lamp has become so inefficient that it is advisable to throw it away and buy a new lamp. The best lamp is, therefore, the cheapest lamp which will burn the longest time with the least fall in efficiency (lumens per watt).

Color of Light.—The light should have a color suitable for the work to be performed.

THE REFLECTOR

Efficiency.—The ratio of total lumens from the combined lamp and reflector to the total lumens from the lamp alone should be high.

Distribution of Light.—It is principally the light in the 0-deg. to 65-deg. zone that is of use, therefore the light shown by the distribution curve of the reflector should fall as closely within these limits as possible. The greater the candlepower of the light in the 65-90 deg. zone the greater the glare, and the nearer the high candle-power is to the 90-deg. zone the more objectionable it is. Some light, to light upper portions of the room, should be contained in the 90 deg. to 180-deg. zone, as it causes a strain on the eyes to have too great a contrast between the lighting unit and its surroundings.

Shield Light Source.—The light-producing surface of the lamp should be shielded from the eye, as modern light sources are too intense for the eye to view with safety. Furthermore, the brightness of the lower surface of the reflector should be low.

Maintenance.—The reflector should be durable and the reflecting surface should not deteriorate with age, heat of the lamp or fumes of the shop. It should withstand frequent washing and after washing should present a surface equal to the surface which existed initially.

Fan, Blower and Air-Compressor Applications

Operating Characteristics of Different Types of Apparatus for This Service—Motors and Control Equipment Best Adapted Thereto and Methods of Connecting

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

This article takes up the application of the motor to a line of apparatus where the horsepower requirements vary in general as some function of the speed other than the first power. Characteristics relating to the power requirements of fans, blowers and air compressors are outlined, and attention is called to the types of motors and control apparatus which are usually employed for driving this line of machinery. The mechanical connection of the motor and the machinery to be driven is treated both from the viewpoint of the efficiency of the system as a unit and from that of such incidental items as the avoidance of noise, which is relatively important in some applications. Specific types of fans, blowers and air compressors are discussed somewhat in detail.

OF THE different types of apparatus available for impelling air or delivering it under pressure, the rotary blower is used principally for those cases where the air passages to and from the fans are unobstructed, as in some cases of ventilating, cooling and exhaust service. Blowers like those illustrated in Figs. 3 and 4, although not of the positive types, are adapted, because of their ability to develop some pressure, to those cases where a continuous supply of air is required for ventilating, blowing, drying or other purposes and in which there is some resistance to the flow of air which makes necessary the pressure produced by this type.

For many cases where large volume and relatively high air pressure is required, as in the blowers for oil and gas furnace work, in the burning of pulverized coal, for the blasts used with foundry cupolas, in ash and coal conveying, for the transmission of cash and mail pneumatically, for blast-furnace work and the like, air compressors are used. The centrifugal air compressor is a type which is widely used for the above purposes.

OPERATING CHARACTERISTICS

The variations of the horsepower and efficiency of fans and blowers with speed, dimensions of the outlet and density of the gas handled are important items in the operation of such devices. For a given area of the discharge opening the horsepower required to drive a fan or a blower depends on the cube of the speed. Hence it will be noted that at starting the torque required is negligible as far as the load is concerned, being due only to the mechanical friction and the inertia of the comparatively light revolving parts. As the fan or blower speeds up the horsepower rapidly increases according to this variation as the cube of the speed. Starting requirements are thus of little or no importance in such apparatus.

For a given area of the discharge opening and with constant speed the horsepower required by a fan or blower varies directly as the density of the gas handled. It is interesting to note that the efficiency of fans or blowers is unchanged by variations in speed, and in this respect they differ considerably from other machinery. The efficiency does vary, however, with changes in the opening of the discharge area.

Leonard[1] gives the following information concerning the variation in the horsepower for fans and blowers for given driving speeds and with a decrease in the size of the discharge area. For a centrifugal fan the horsepower decreases with a decrease in the area of the discharge orifice. With a propeller fan, however, the horsepower increases as the area of the discharge orifice decreases. Thus in some designs the horsepower for a propeller fan with its rated orifice is one-quarter or less of the horsepower with a complete discharge restriction. In the case of positive blowers, owing to the very small clearances between the rotating element and the casing, the horsepower increases rapidly with decreasing values of the discharge orifice area.

TYPES OF MOTORS USED

The smaller types of fans and blowers, like those represented by Figs. 2, 3 and 4, are available with either direct-current or alternating-current motors and can

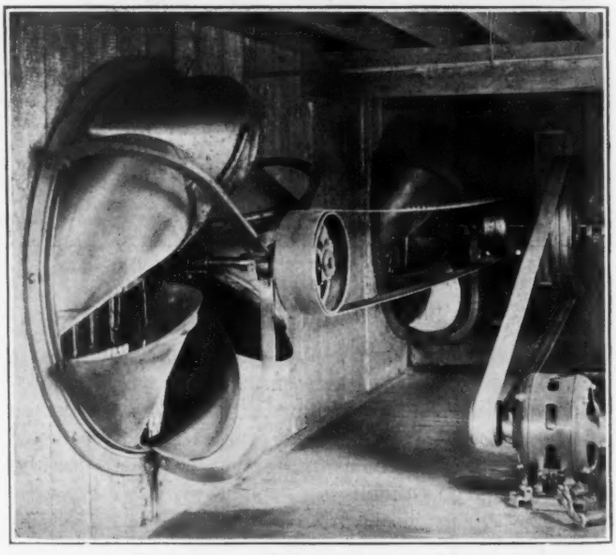


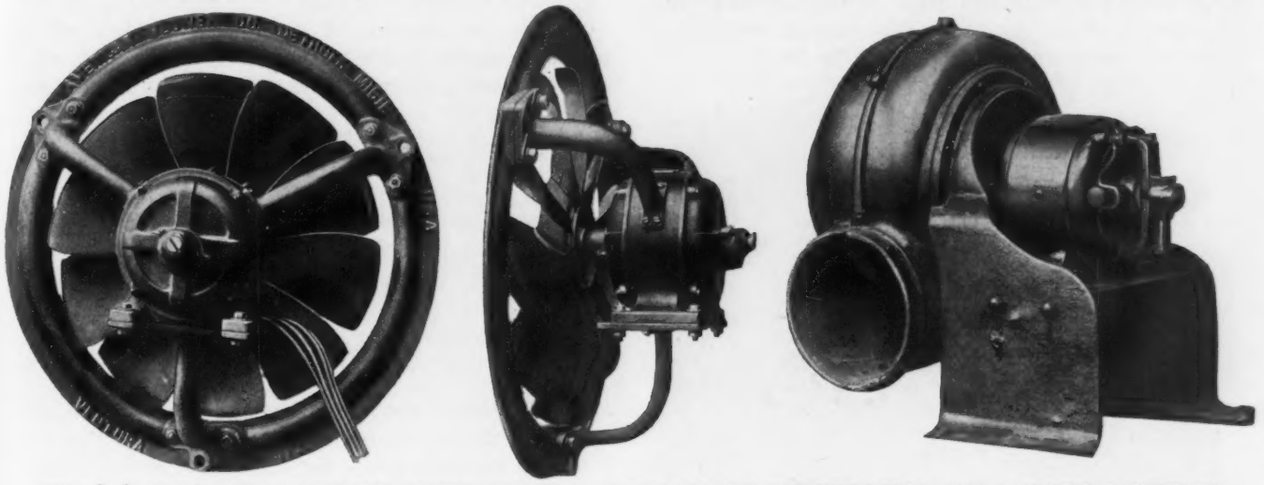
FIG. 1—LARGE EXHAUST FANS DRIVEN BY HIGH-SPEED MOTOR

be operated from any ordinary electric light circuit without a starting rheostat. For fans of the kind shown in Figs. 2 and 3 single-phase alternating-current motors are employed, and when operated on direct-current supply circuits motors of the series-wound

[1]See classification by M. S. Leonard, in "Standard Handbook for Electrical Engineers," fourth edition, page 1237. Frequent references have been made in the preparation of this article to this section by Mr. Leonard on "Fans and Blowers," and also to the section on air compressors by J. H. Brown, Jr., page 1235 of the "Standard Handbook," and to information and illustrations placed at the disposal of the writer by the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Crocker-Wheeler Company and the Wagner Electric Manufacturing Company.

type are used. For the blowers shown in Fig. 4 single phase alternating-current motors or shunt-wound direct-current motors are used.

A more comprehensive statement concerning the types of motors to use for fans and blowers in general is as follows: With an alternating-current supply all types may be driven by induction motors. With a direct-current supply shunt-wound motors are best for centrifugal fans; for propeller fans either the shunt or the series motor may be used, although the latter is preferable. For positive blowers the shunt motor is recommended.



FIGS. 2, 3 AND 4—SMALL FANS THE MOTORS OF WHICH DO NOT REQUIRE STARTING BOXES, AND A BLOWER ADAPTED TO CONDITIONS WHERE THERE IS SOME RESISTANCE TO THE FLOW OF THE AIR

Fans of the type shown in Fig. 1 are made in a wide variety of sizes, and the speed of driving decreases with the increasing dimensions of the fan. Some idea of the speeds in r.p.m. of these fans for a number of different fan diameters together with the volume of air moved per minute may be gained from the accompanying table, which covers equipment for 115, 230 and 500-volt service.

Centrifugal air compressors of the single-stage type are driven from alternating-current supply circuits by squirrel-cage induction motors, in which case the motor is of course of the constant-speed type and the driving speed cannot be adjusted. It is necessary, therefore, in the application of such motors to specify a pressure high enough to take care of the range of the operating requirements. Where the supply is direct-current, shunt-wound motors are used, with commutating poles and a so-called shrunk-ring commutator for providing sparkless commutation.

For displacement air compressors self-starting synchronous motors or induction motors may be used, although the former type is recommended for direct-connected sets in the larger sizes. Among the advantages of the synchronous motor as now used for compressors of this type are their self-starting as well as self-synchronizing characteristics, continuous operation even with low line voltage or other power disturbances, high efficiency, absolutely uniform speed and high power factor.

Since the rotating element of a standard synchronous motor does not usually in itself possess sufficient flywheel effect to prevent undue fluctuations in the current with successive strokes of the compressor, it is desirable to use a flywheel on the compressor shaft. This added flywheel effect tends to maintain the operation of the motor in case of an unusual momentary drop in the supply voltage. For the smaller compressors induction motors are usually employed because of the lower cost for this type in the smaller sizes compared with that of the synchronous motor.

METHODS OF CONTROL

As pointed out above, the very small sizes of fans and blowers do not require starting rheostats, being merely connected to the line by an ordinary snap switch. In general, however, any direct-current motor-driven fan or blower which is to be operated at one speed only irrespective of the service conditions requires at least a starting rheostat with a no-voltage release, and in

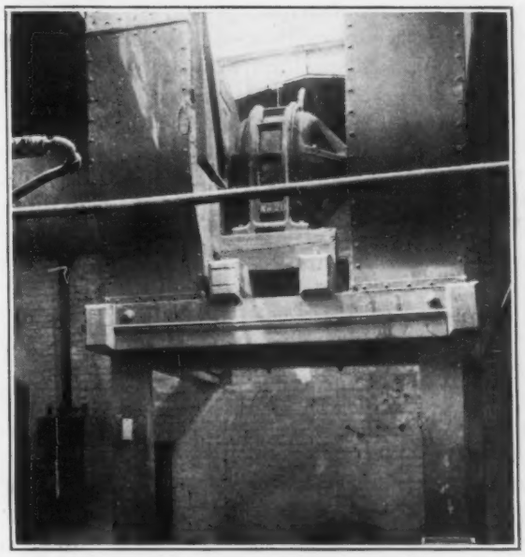


FIG. 5—THREE-PHASE INDUCTION MOTOR DIRECT-CONNECTED TO TWO EXHAUST FANS

case there is a likelihood of an extraordinary increase in horsepower an overload release will also be found essential.

Where speed adjustment is required two conditions may arise: (a) The motor operates for the most part at normal speed with occasional times when reduced speed is necessary, or (b) the motor operates for most

of the time at speeds below normal and is occasionally brought up to speed at or near normal. In case (a) armature resistance control may be used, while in case (b) field control is more economical. Values for the speed ranges usually met with in practice are for a decrease of, say, 50 per cent below normal for armature resistance control and for about 10 to 25 per cent in-

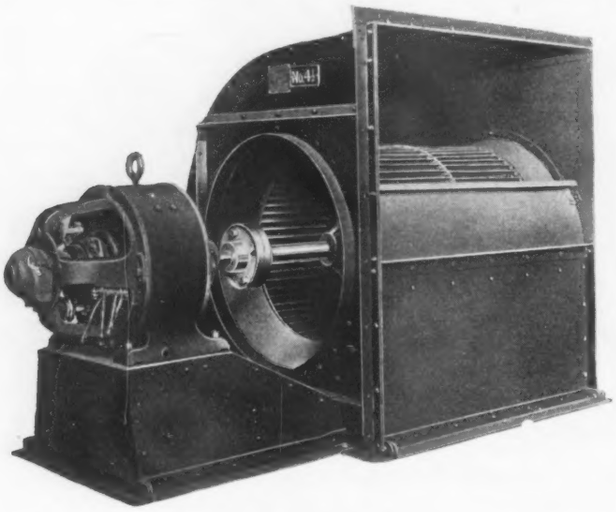


FIG. 6—LARGE MOTOR-DRIVEN VENTILATING FAN

crease in speed above the ordinary average operating speed by field rheostat control.

With alternating-current motor drive for fans and blowers the motor is usually equipped with a starter only, and necessary changes in the volume or pressure of the air or gas are produced by throttling rather than by changes in speed.

With centrifugal compressors the practice of one representative manufacturer is to furnish a standard starting compensator with a self-contained oil switch, low-voltage release and overload relays for all compressor motors of the induction type of 5 hp. and above. For induction motors of 5 hp. and lower an oil switch with overload relays is furnished. For the control of direct-current motor-driven compressors each motor is furnished with a suitable field rheostat so as to make possible adjustments in air pressure by changing the speed of driving. Motors of 50 hp. and less are furnished also with standard starters, and with the larger sizes standard panels are used. The panels are equipped with field and armature resistance and switches both for starting and for controlling the speed of the motor.

Centrifugal compressors, when driven by induction motors, are operated at constant speed, and from the control standpoint the pressure rise of the compressor cannot be regulated by speed changes. On the other hand, it is always possible to throttle the pressure, with, however, no change in the volume capacity of the compressor. In contrast, the direct-current motor-driven compressors are adapted to some slight speed variations which produce corresponding pressure changes. As an example, a centrifugal compressor rated at 4500 cu. ft. (126 cu. m.) of air per minute at a pressure of 1 lb. (70.3 gm. per sq. cm.) and speed of 3450 r.p.m. produces a pressure of about 0.87 lb. (61.2 gm. per sq. cm.) and 4200 cu. ft. (117.6 cu. m.) of air per minute at a speed of 3200 r.p.m., and about 1.15 lb. (81 gm. per sq. cm.) pressure and 4200 cu. ft. (117.6 cu. m.) per minute at 3700 r.p.m. Hence it is possible to operate the direct current motor-driven set at as much as 20 per cent overload for a period not to exceed two hours.[2]

METHODS OF CONNECTING THE MOTOR

Of the two methods of connection, by belt and by direct connection, the former is recommended where the elimination of noise is essential, as in auditoriums,

DATA ON FAN DIAMETERS AND PERFORMANCE

Diameter of Fan (In.)	R.P.M.	Cubic Feet of Air per Minute
18	900	2,700
24	700	5,000
30	600	8,400
36	500	12,000
42	410	15,400
48	400	23,000

schools, hospitals and the like. Lower first cost of high-speed motors is also an advantage in this connection. Since the desirable speed for fans is not likely to agree with the rated speed of an alternating-current motor, belt connection is often essential with motors of this type.

Where direct connection is employed various standard methods of mechanically mounting the motor and making the connection to the fan are used. In larger sizes of compressors direct connection is always desirable, and the more so because of the ability to design the larger compressors for low speed.

SPECIFIC TYPES

Fans of the type pictured in Figs. 2 and 3 are designed to draw the air directly from a room, for example, and

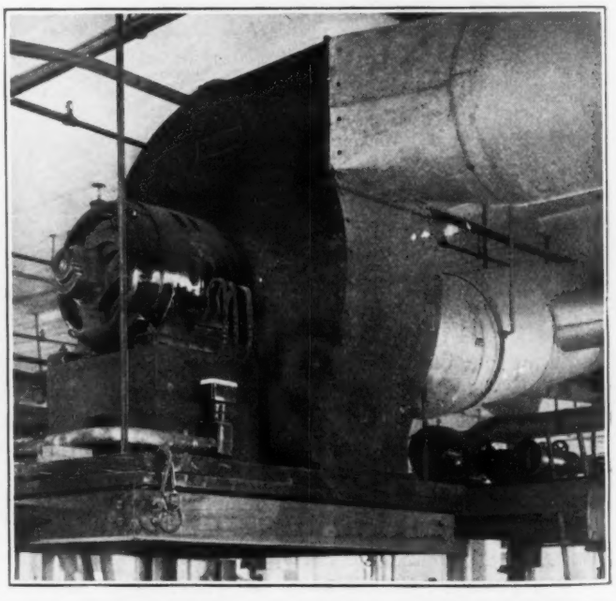


FIG. 7—LARGE BLOWER DRIVEN BY THREE-PHASE, SQUIRREL-CAGE MOTOR

to exhaust it into the open, and also for cases where the inlet and outlet pipes are sufficiently large and short so that there is little or no resistance to the passage of the air. The disk at the center prevents back flow and the

[2]Data based on Bulletin No. 48,609 (1917) of the General Electric Company.

turned-in ends of the blades give the fan a higher efficiency than older types. This type is made in sizes ranging from a wheel diameter of 18¾ in. to 32 in. (45.72 cm. to 81.28 cm.), with capacities ranging from 1860 cu. ft. to 6530 cu. ft. (52.0 cu. m. to 182.8 cu. m.) per minute.

The type of blower shown in Fig. 3, while capable of supplying air for ventilating and other purposes where there is some resistance to the passage of the air, is not a positive blower in the strict meaning of that term. This type is made in sizes ranging from a wheel diameter of 4½ in. to 9 in. (11.4 cm. to 22.8 cm.), with capacities ranging from 175 cu. ft. to 700 cu. ft. (4.9 cu. m. to 19.6 cu. m.) per minute. Both types of fans just mentioned can be driven by small motors ranging from 1/20 hp. to ⅛ hp.

Centrifugal air compressors are used for a wide variety of applications and possess advantages over the displacement compressor in some cases. For example, in the pneumatic handling of cash in department stores, when the suction lines are opened to insert a cash carrier, the centrifugal compressor responds quickly by drawing in a large volume of air sufficient to pull the carrier along by the high air velocity thus produced. A positive pressure blower is more sluggish and in the ordinary sizes which would be employed for a given system would not respond to such quick changes.

Where direct-current motors are used for such compressors as pointed out above, increased speed produced by the adjustments which are possible with these motors creates increased pressure. However, since the volume of the air or gas which can be handled is limited by the rating of the driving motor, the volume must be reduced in proportion to the increase in pressure so as not to exceed the capacity of the motor used.

The foregoing notes point to some of the practical phases in the operation of these lines of equipment. The necessity for care in the selection of the motor for each individual case, particularly in the blowers and compressors of the larger sizes, is apparent from the numerous items which demand attention in the operation of such appliances.

Successful Operation of Secondary Networks

A Discussion of Various Important Points, the Neglect of Which Has Resulted in Many Failures in Attempts That Have Been Made to Operate Interconnected Secondary Networks

BY S. BINGHAM HOOD
Superintendent of Distribution, Northern States Power Company

THE well-known reliability and flexibility of direct-current networks has resulted in many attempts being made to operate alternating-current networks along similar lines. These attempts have met with all degrees of success and failure, depending largely upon the amount of care and forethought that have been put into the design and construction of the network. In the vast majority of cases failures in continuity of service can be traced back to an absolute disregard of the underlying principles involved.

A secondary network is very similar to the direct-current system as regards the distribution of currents under both normal and abnormal conditions; consequently the basic principles governing the distribution of currents in parallel circuits can be applied to each. In the alternating network, fed by many step-down transformers of moderate rating, each transformer becomes the equivalent of a direct-current feeder. The primary network can then be considered as the equivalent of the direct-current substation bus. Having these comparisons clearly fixed in mind, the problem is at once greatly simplified.

THE FUSING PROBLEM

Each individual transformer unit feeding the network may be compared to a very short feeder having low resistance and must be protected on both the primary and secondary sides by fuses which will open in case of abnormal demands for current, or for faults within the transformer windings which would result in drawing exceedingly heavy currents from both the primary and secondary networks. For the primary side there are numerous makes of fuses that can be depended upon to operate successfully under all conditions likely to be met in practical operation.

For the secondary side the problem is complicated by a lack of suitable fuse holders and fuses that are moderate in first cost and reliable when exposed to the weather for long periods of time. Since these fuses are so located that the fire hazard to nearby apparatus is very slight, it is not necessary or desirable to attempt to use any of the standard types of inclosed fuses whose cost and complications are those involved almost entirely by the necessity of furnishing protection from fire when the fusible element is ruptured. For this reason fuses for protection of the secondary of distribution pole transformers may be made of exposed noncorrodable metal links mounted in simple exposed metal clips and terminals. A type of fuse and holder which has proved successful for such use was described in detail in the Aug. 25, 1917, issue of the ELECTRICAL WORLD (Vol. 70, No. 8). The neutral wire of the secondary system must in all cases be permanently and effectively grounded and must be continuous without fuses throughout its length, including the neutral lead of the transformer secondary winding.

In fusing distributing transformers it is absolutely necessary to have both the primary and the secondary fused heavily, particularly when they are operated in parallel on a network. Fuses rated at from two and one-half to three times full-load current are none too heavy. Objection to such overfusing is generally based on the resulting danger of burning out the transformers from overloading. The maximum load on any transformer should be determined by a system of periodic tests and a record of loads connected in the period be-

tween tests. On any network there are numerous momentary demands for current which will result in unnecessary interruptions to the service if an attempt is made to limit the loading by means of fuses rated close to the normal capacity of the transformers feeding the load.

DESIGNING THE SECONDARY SECTIONS

In any interconnected network there is a definite section supplied by each individual transformer. Each of these sections should be so designed that the transformer is at the approximate center of the load on the section, being preferably so located that the current is distributed in a number of directions. This can be accomplished by locating transformers at junction points of the secondary mains. Generally speaking, however, it is not desirable to place transformers on junction poles owing to the already complicated wiring on such poles. It is, therefore, necessary to select a location as near as practicable to such junctions.

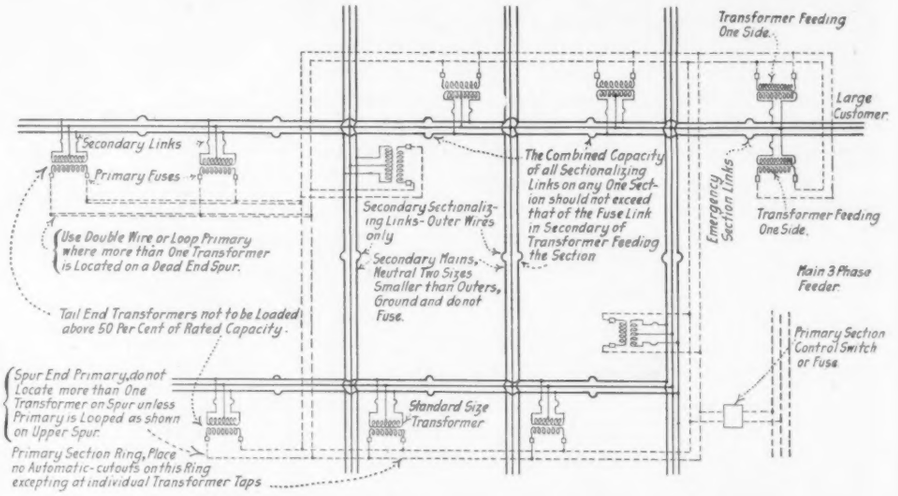
Having a group of such properly designed secondary sections, it is then only necessary to interconnect between them to form a network for parallel operation. In many systems the design has been carried out properly to this point, but has failed from other causes, as outlined below.

In the event of failure of any transformer on the network its load must be immediately taken up by adjacent transformers if continuity of service is to be maintained. As a transformer will safely carry a 50 per cent overload for a short time, it therefore follows that the minimum number of transformers operated in parallel is fixed at three. It also follows that the more transformers there are connected in parallel the smaller proportionate overload each will bear when any one unit fails. It also follows that all units feeding into any interconnected network must be of the same rating, otherwise a failure of any larger unit will disproportionately overload the smaller one adjacent thereto. This lack of uniformity in transformer sizes has been responsible for a large proportion of the failures.

Where a standard-size unit is used the transformer stock becomes simplified, and increases in load can be taken care of on the network at small cost by simply installing additional transformer units between those already existing, moving, where necessary, the adjacent units further apart.

In selecting the unit transformer for any district due regard should be given to the probable future development of the section to be served. In a district which is growing rapidly, as in many of the newer residential sections, a fairly large unit should be used, probably from 15 kva. to 25 kva. rating. This involves running moderately heavy secondary mains over considerable distances in order that the initial units may be economically loaded. This practice is, however, the most economical in the long run, as it permits taking on additional load as the district develops, by adding transformer units at intermediate points on the existing mains. This practice is particularly desirable where an electric cooking load is increasing. If the old practice is followed of installing small secondary mains and small transformer units, the cost of continually increasing their size as new load comes on will mean a heavy ultimate expenditure and rapid depreciation on the original investment.

To secure the best results in network operation the secondary mains should be connected in a series of rings, each ring surrounding one or more blocks of the district served. With this layout there is no point at which the failure of one transformer will overload adjacent units more than the maximum allowance of 50 per cent. A further advantage is that of continuity of service, even if the secondary main should break at any point. In practice, however, there will generally be a tail-end section on the network, the failure of the transformer feeding which would result in placing a 100 per cent overload on the next unit. In order to avoid this condition, which in a long single-main secondary would result in a general blowout, it is imperative that the end transformer feeding any tail-end section must never be normally loaded more than 50 per cent of its rating. As this is not a very economical operation, it follows that these tail ends should be avoided wherever practicable. This can usually be accomplished by running an extra heavy secondary main from the nearest point on the network at which the interconnected ring system can be tapped.


Transformer Feeding One Side.
Large Customer
Secondary Links
Primary Fuses
Use Double Wire or Loop Primary where more than One Transformer is Located on a Dead End Spur.
Secondary Sectionalizing Links - Outer Wires only
Secondary Mains, Neutral Two Sizes Smaller than Outers, Ground and do not Fuse.
The Combined Capacity of all Sectionalizing Links on any One Section should not exceed that of the Fuse Link in Secondary of Transformer Feeding the Section
Emergency Section Links
Transformer Feeding One Side.
Main 3 Phase Feeder
Primary Section Control Switch or Fuse
Tail End Transformers not to be Loaded above 50 Per Cent of Rated Capacity.
Spur End Primary, do not Locate more than One Transformer on Spur unless Primary is Looped as shown on Upper Spur.
Standard Size Transformer
Primary Section Ring, Place no Automatic-cutouts on this Ring excepting at individual Transformer Taps

A TYPICAL SECONDARY NETWORK DETAILING THE VARIOUS POINTS BROUGHT OUT

A study of this sketch will show clearly the reasons for the points taken and will show why their non-observance will result in frequent failures.

RING-TYPE PRIMARY SYSTEM ADVISABLE

For the purpose of feeding the various transformers of the interconnected network the primary system requires special consideration. Having a backbone primary feeder with numerous tapped mains taken off to feed the various transformers, as is the practice with non-interconnected transformers, will not give safe operation on an interconnected network. The reason for this is that a break at any point on the primary system within the network area will result in those

transformers on the supply side of the break feeding the rest of the load beyond the break through the intermediate secondary-network section. The natural and inevitable result of this will be a general and wholesale blowout of the entire network. In order to overcome the possibility of such an occurrence, the primary system must be connected in a series of one or more closed rings. At no point must more than one transformer unit be located on a single spur taken off this primary ring. Such a ring system has many other marked advantages, such as equalization of voltage, minimum amount of copper for diversified loads, ability to cut out sections for repairs without interrupting service, etc.

The primary ring-connected section should be independent from the general primary feeder and connected solidly, without automatic cut-outs, throughout the section served. This individual primary section should then be controlled by an individual switch or cut-out installed where the section taps off the main feeder.

Where the source of supply is a three-phase system it is good practice to divide the district served into three distinct sections, feeding each from one of the three phases of the feeder. This involves, in large systems interconnecting in each section, probably from 300 kw. to 500 kw. in local transformer rating. To those who have met with difficulty in parallel operation this may appear to be an abnormally large section on which to locate trouble, particularly if a total interruption occurs. With a properly designed network, however, such widespread interruptions will be so rare that the probability of such an occurrence can be neglected. In one large city where this sort of parallel operation has been operated for a number of years there has not been a single network interruption since the inception of the system. Moreover, the failure of individual transformers from lightning and other causes has been remarkably reduced, such failures now being so rare that their occurrence is considered quite an event in the operation of the system.

Consideration of Special Conditions

Where transformers are operated in parallel on a widespread network it is important that the customers served be encouraged to report poor service promptly and that such reports receive immediate attention. In a good system of secondary distribution the normal drop in voltage should not exceed 3 per cent of lamp voltage. With transformers properly spaced the failure of any single unit will then result in a drop of 12 per cent in lamp voltage for customers very near to the defective unit. Such a drop will result in customers' complaints of poor light as soon as the evening peak comes on. By having a troubleman go to the nearest transformer unit the trouble is at once located and can be corrected before further failures occur.

It frequently happens that heavy concentrated loads, such as those of apartment houses or large buildings, must be served in the same district as that covered by the secondary network. Such loads should not be considered as a part of the network, but should be treated as independent units. In serving these it is best to provide two transformers, each having its secondary connected for say 115 volts, the two being connected in series across the three-wire service line. A continuation of this service line should then be connected to the nearest point of the interconnected secondary network through fuses of small capacity. The individual bank then becomes a reserve for the network, and the network can be used for emergency service during periods of light load. In the event of failure of either of the individual units the network emergency fuse will blow and one-half of the concentrated load will be deprived of its service. Under this condition service can usually be restored in a short time by having the troubleman advise the tenants to curtail their demands, after which he connects the two outside wires together on the transformer pole pending replacement of the defective transformer. If the character of the load is such that these infrequent interruptions are not permissible, then three units should be installed. If this be done, heavy choke coils must, however, be connected in the leads of each unit, otherwise failure of any one of the three will almost surely interrupt the remaining two owing to the heavy rush of current and very small difference in the time element of the protecting fuses.

Progress for the A. S. M. E. Boiler Code

A bulletin of the American Uniform Boiler-Law Society, dated Jan. 10 and signed by Thomas E. Durban, chairman of the administrative council, shows progress in the legal adoption of the A. S. M. E. boiler code. Prospects are reported in the following states in which legislatures convene during the present year: Georgia, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Rhode Island, South Carolina and Virginia. The society is writing to prominent men in these states, including members of the American Society of Mechanical Engineers and the National Electric Light Association, requesting co-operation. The National Electric Light Association, through R. J. McClelland, has written the following letter to the society:

> We wish to assure you that the National Electric Light Association indorses fully and heartily the work of the American Uniform Boiler-Law Society, and that you may rely upon our moral support in the various campaigns and representations which you are undertaking. Your work is a most valuable one, not merely to the engineering profession but to the welfare of the country in general. At a time when the industrial resources of the country are being subjected to the most severe test in their history, the measures of efficiency, uniformity and security for which you are working assume proportionately greater importance, and we shall be glad to supplement in any manner practicable the assistance which our small contribution may afford.

Electricity to Help Farm Production

The electrical engineering department of the Iowa State College is planning an extensive exhibit of electric appliances and farm lighting sets for the farm and home short-course week at the college, which will be held from Jan. 28 to Feb. 2. The farmer must help in speeding up production. Electric lighting, electric motor-driven machines and other electrical appliances will serve as important factors in this increased production. With these conveniences the farmer can do faster work with fewer mistakes. This is the belief of the electrical department, which is concentrating every effort to make the exhibit a success. F. D. Paine is electrical engineering representative of the winter short course.

Importance of Water Power Is Shown by War

Benefits of Cheap Power and Conservation of Fuel Far More Valuable to the Nation than Exact Solution of Question of Restricting Return on Capital to Irreducible Minimum

BY CALVERT TOWNLEY

As a representative of the Engineering Council Mr. Townley, who is assistant to the president of the Westinghouse Electric & Manufacturing Company, made the statement of which this is a summary before a special committee of the United States Chamber of Commerce at Washington on Jan. 14. The statement is not an expression of Mr. Townley's personal views, nor of those of any group, but has been submitted to and approved by the executive committee of the Engineering Council.

BEING empowered as it is to speak for the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers on matters of common concern to all of these bodies, the Engineering Council's official utterances concern only such underlying principles and economic facts as are indorsed by all engineers and beyond the field of controversy.

Accurate statistics are difficult to obtain, but some approximate totals may prove illuminating. It has been estimated by a careful engineer that in 1911 there was over 26,000,000 steam engine horsepower capacity in use (including railroad locomotives) in the United States. The aggregate water horsepower developed and undeveloped has been computed as around 60,000,000. Of this latter the United States Census of 1912 gives 4,870,000 as developed, and in a report of January, 1916, the Secretary of Agriculture estimates this total to have been increased to 6,500,000. Making liberal allowances for correction in these several figures, it seems probable that there is in service from four to five times as much steam as water horsepower and that there is still undeveloped water horsepower equal to at least twice all the steam power in service.

The Elements of Cost

The price for service depends primarily on cost, and cost divides itself naturally into two main items, namely, operation (including maintenance) and fixed charges. As a hydroelectric plant consumes no fuel, its operating cost is less than that of an equivalent steam-driven plant. On the other hand, a steam plant costs usually only from one-fifth to one-half as much per unit of capacity as a hydroelectric plant, so that the latter must carry very much heavier fixed charges.

A power enterprise seldom comes into being with a market for its entire ultimate output. Therefore, when steam is to be the motive power, only such capacity is installed as initial demands require, and the cost per unit is fairly proportional to that of the ultimate development. In a water development, on the contrary, a large part of the cost is for riparian rights, for the dam, impounding reservoir, flume, forebay, etc., and for the transmission right-of-way, towers, etc., which must be at the start largely provided and constructed for the complete installation. In forecasting the commercial prospects of a power enterprise the possible market must be studied, and, of course, a sale price for power decided upon. As this price is controlled by the cost of similar service from other sources, usually from steam, and as it must be attractive from the start, the additional burden of fixed charges on the initial part of a hydroelectric installation frequently forces the sale of its power below cost. The projectors then must rely for success on a sufficient subsequent increase in their markets.

Rising Coal Price Met by Improved Machinery

The rising price of coal is a matter of record, but it is not so generally known that the improved efficiency of steam-producing machinery (boilers, engines, generators and auxiliaries) has more than kept pace, so that the net cost of producing electric power from coal has steadily declined. As applied to the pre-war period, it may be stated that over a period of ten years the cost of coal has risen on an average 1 per cent per year, while the cost of electric power produced from coal has fallen on an average 2½ per cent per year.

In addition to these facts—still referring to pre-war conditions—the cost of steam-electric generating equipment has been greatly reduced. This fact is due partly to the introduction and subsequent improvement of the steam turbine and in part to the great increase in the size of the units now available. There is nothing to indicate that the limit of improvement in the design of steam prime movers has been reached or is even in sight. It is, therefore, a reasonable assumption that further advances in the art will continue to occur and to cut down both the fixed charges and the operating cost of steam power as a competitor of water. The largest modern steam turbine has now some twelve times the capacity which the largest reciprocating engine had fifteen years ago.

In addition to the development of steam prime movers, the Diesel or the internal-combustion engine is now coming largely into use as a further competitor of water power where fuel oil is available, as in the southwestern district of the United States. The efficiency of these engines is considerably higher than that of the small-size steam turbine and reciprocating engine. There has not been a like improvement in the efficiency nor a comparable reduction in cost of the small reciprocating steam unit, and a natural result has been expansion of the central stations.

The cost of producing power from either water or steam is a function of load. Fixed charges remain practically unchanged in both instances, whether the output in energy be large or small, but with a steam plant increased output means increased fuel consumption, while a water plant operates either with or without load with but little variation in expense. To illustrate by a concrete example representing not unusual conditions, suppose we assume a steam plant using 2½ lb. of coal per kilowatt-hour at a price of $3 per short ton and having a plant or output factor of 35 per cent.

Under these assumptions the cost of fuel per unit of installed capacity per year would be $11.50, and if the other operating and maintenance charges be assumed fairly to offset those of a water installation of equivalent size, $11.50 represents the additional fixed charges which the hydroelectric plant could carry and produce power at an equal cost. If the fixed charges (interest, taxes, insurance and amortization) total 11½ per cent, therefore, the hydroelectric investment per kilowatt capacity could exceed that of steam by $100.

Stream flow is subject to seasonal variation, and therefore to complete or partial interruption by drought in summer and by ice in winter. Floods are a menace. Long transmission lines may break from wind or sleet or the service be disarranged by lightning. The losses on such lines vary with load and are frequently responsible for annoying pressure variations. On account of these and other reasons hydroelectric power cannot prevail against steam competition at the same or a slightly lower price. It must be materially lower.

THE UNDEVELOPED WATER POWER OF THE WEST

Of the estimated 55,000,000 undeveloped water horsepower in the entire country, approximately 40,000,000 hp. is situated within the boundaries of the thirteen so-called Western water-power states. In these same states the federal government still retains as proprietor 760,000,000 acres, or over two-thirds of the aggregate acreage of all these states taken together. In order to develop power in that section it is therefore nearly always necessary to use some part of this public domain, if not for the dam site itself, at least for flowage, for transmission right-of-way or for some other purpose. Existing law forbids such use except under permit issued by the Secretary of the Interior and revocable without cause, at any time, by himself or his successor in office. It was once believed that revocation would only follow gross abuse well established by evidence, but the drastic action of a one-time Secretary of the Interior some years since to the contrary disabused investors of this confidence. As funds for hydroelectric development must come from private sources, the unstable tenure thus imposed has constituted so great a hazard of loss that the private investor has been loath to assume it. The unfortunate—almost disastrous—result has been stagnation in water-power development.

The several remedial laws recently considered by Congress recognize the essential facts and agree that the remedy is a new law containing the following provisions, namely, an indeterminate permit irrevocable during fifty years except for cause judicially determined, and continuing thereafter unless and until the federal government either renews its permit on mutually agreeable terms or, for itself or through a new permittee, takes over at their fair value the hydraulic works and certain other parts of the development.

The Engineering Council does not consider itself expert in legal matters and will not undertake to discuss the relative merits of the different plans. It should be pointed out, however, that a hydroelectric enterprise being once successfully established, it is alike to the interest of the owners, of the government and of the public that it should continue indefinitely without interruption. There is no economic reason to be served by a cessation, and the only reasons for providing a legal means of recapturing the installation and the water rights are, first, to preserve an additional measure of government control against possible abuse by the permittee, and, second, against a remote contingency which might make it desirable that the government would want to use the power for some other purpose.

FIFTY YEARS' GROWTH FIVEFOLD TO TWENTYFOLD

A successful power enterprise at the end of fifty years will have multiplied the capacity of its initial installation many times, variously estimated at from five to twenty. In nearly all cases steam plants as well as water plants are necessary to supplement hydroelectric power at periods of low water and in case of interruption, as well as in some instances to provide increased capacity. Modern practice is rapidly approaching that of providing steam capacity equal to 100 per cent of hydroelectric for the purposes stated.

Continuing growth makes burdensome and usually abortive any attempt to amortize the investment, while the investment in other water powers or in steam plants, or both, interconnected with and generally dependent for their economic operation on the original development, renders the right to recapture that development only very onerous and one which constitutes a serious impediment to the free and full development of an enterprise which is otherwise most desirable from all standpoints. With respect to power sites on the public domain and on navigable streams, the government is in the position of seeking to have its resources developed without assuming any business hazard and without contributing either capital or credit.

It would be unfortunate, in the light of past experience, if any new laws which may be enacted should put the government in the position of bargaining with capital and of offering just sufficient incentive not to induce capital to undertake the developments desired, thereby, while apparently providing a remedy, in reality insuring a continuance of the present undesirable condition. Hydroelectric enterprise must compete with the demands of other industries for capital. Experience has shown that even without the imposition of additional financial burdens many of them are not sufficiently attractive to secure development, and as the attractive prospects grade by imperceptible degrees into the unattractive ones, it is perhaps self-evident that every additional burden, however small, transfers a percentage of such projects from commercial into uncommercial prospects.

It is our belief that the benefits afforded the communities served by cheap power, and to the nation by the conservation of coal resulting from the substitution of a self-renewing for a non-renewable natural resource, are far more valuable than is the exact solution of the question of restricting the returns to capital to their irreducible minimum. The present emergency due to the progress of the war has forcibly illustrated the importance of having developed the greatest possible number of water powers as a source of industrial power supply. As it consumes no fuel, the substitution of water for steam power would release to other uses all the extensive railroad and water facilities now engaged in transporting coal. It would similarly release a corresponding volume of labor now occupied in mining this coal and in operating such transportation agencies as well and the boiler-room forces of the steam-power plants themselves.

STATION & OPERATING PRACTICE

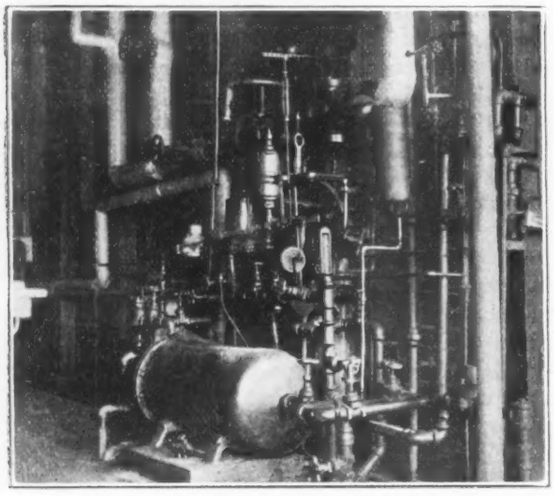
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

RESULTS OBTAINED BY USE OF FUEL-OIL REGULATOR

Supplies Larger Quantity of Fuel Oil to Grates, and by Its Use Oil Is Sprayed Properly and the Draft Is Increased

The Houston Electric Company of Houston, Tex., has recently installed in its plant a device for automatically regulating the amount of fuel oil fed to the furnaces under its boilers. The regulator is arranged to operate with the increasing and decreasing load. In fact, the device is more than merely a fuel regulator. It is an automatic draft, fuel oil and injector-steam regulator which absolutely controls the three essentials to boiler operation when crude oil is used for fuel.

When a sudden load is placed on the main generator of the plant it will naturally cause a drop in the main steam-pressure line. This causes a drop in the steam line which is used for spraying the oil over the grate, as



INSTALLATION OF AUTOMATIC FUEL-OIL REGULATOR

steam for this purpose is obtained through a reducing valve from the main line. This reduction in pressure causes the regulator to function. When this regulator acts, it performs three duties simultaneously: First, it supplies more fuel oil to the grates; second, a greater quantity of steam is released to cause the oil to spray properly, and, third, the draft over the fire is increased. These three operations make the steam come quickly up to standard practice.

The point at which the regulator will function has been selected by adjusting it according to the steam pressure desired and also taking into the account the CO_2 record produced by a Hayes automatic CO_2 recorder. This recorder is interconnected so that it can be used to take readings from any of the four boilers in the boiler room.

An average of the oil consumed from November, 1916, to August, 1917, showed that the plant used 2.1169 lb. of oil per kilowatt-hour. During September, October and November, 1917, since the CO_2 recorder and the automatic regulator have been placed in service, the oil consumption has amounted to 2.010 lb. per kilowatt-hour. These figures show that the automatic operation has effected a saving of 0.1009 lb. of oil per kilowatt-hour. This indicates a saving of 4.95 per cent in the amount of fuel used. Since the company's fuel bill in the average month is $3,735, it may be seen that the saving effected is 4.95 per cent of $3,735, or $184. Since the automatic devices cost only $390, it will be seen that one will virtually pay for itself at the end of two months.

NOZZLE FOR CLEANING SURFACE CONDENSER TUBES

Description of Outfit Used Which Can Be Operated by One Man—Improvements Over Other Types of Apparatus Used for This Purpose

A simple and efficient nozzle for cleaning surface condenser tubes, which is far more rapid, yet more thorough, than the usual form of rod and brush, may be utilized where air under pressure is available. The cleaning outfit consists essentially of a piece of ¼-in. (0.6-cm.) pipe bent to shape, a reducer, a ½-in. (1.3-cm.) T, a pair of regulating valves and suitable lengths of air and water hose. Air is required under 60 lb. per sq. in. (4.2 kg. per sq. cm.) pressure or more. A check valve should be placed in the air line to obviate any chance of water getting back into the line. The head is taken off at one end of the condenser; at the other end only the hand-hole plates are removed. The nozzle is rapidly moved from tube to tube at the open end, and the dirt, consisting mostly of mud and seaweed, is expelled from the tube by the scouring action of the air and water. After the washing is complete, the ejected mud is scooped out through the hand-holes at the other end of the condenser. By this means one man can clean a 4000-kw., 10,000-sq. ft. (900-sq. m.) surface condenser, containing approximately 3400 15-ft. (4.6 m.) 2⅞-in. by ¾-in. (7.3-cm. by 1.9-cm.) tubes, in six hours, not including the time required for removing and replacing the condenser head and plates. The operator must wear a rubber coat and a helmet.

It is stated by the station operators of the San Diego Consolidated Gas & Electric Company, who utilize this form of nozzle, that this method of cleaning is a great labor saver. When the air and water nozzle was first used hollow cylinders of mud and sewage were ejected from many of the tubes, showing the new method to be a decidedly thorough cleanser. It is understood that some central stations use sand blasts for cleaning tubes. With the particular forms of sediment encountered in San Diego, no scale being present, sand appears to be unnecessary, and the wearing action which may result from the use of sand is not experienced.

CHECKING SYNCHROSCOPES FOR USE IN PHASING OUT

Dangers of Crossed Connections Must Be Eliminated—Method of Using Synchroscope for Phasing Out Apparatus

BY C. OTTO VON DANNENBERG

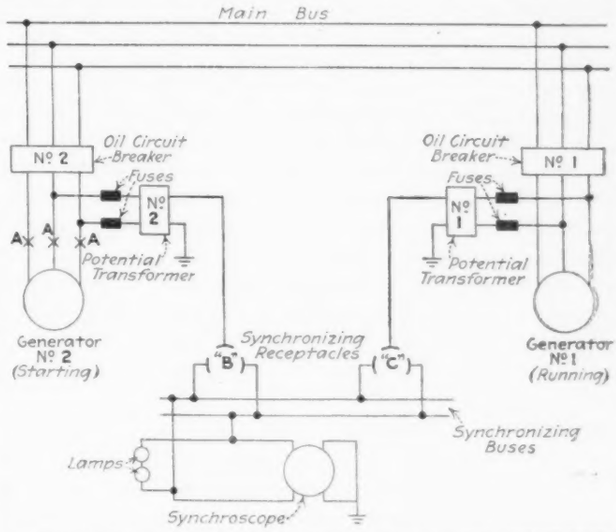
It is an interesting fact that while much valuable and useful information has been published covering various methods of phasing out generators, transformer banks and circuits, there seem to be few actual published data available covering the checking and putting into operation of the synchroscope. The following method is neither new nor original, but the writer does not believe that it has received the publicity and consideration that it merits:

The synchroscope most universally used is of the single-phase type, and, assuming that the connections of the circuits under consideration have been checked, the wiring will be in general as in Fig. 1 for a three-phase circuit. Only the necessary connections under consideration have been indicated, and in this case it is assumed that two three-phase generators are about to be paralleled and that the phase rotation has been found by test to be correct. The generated voltage is assumed to be of such a value as to require the use of potential transformers to step down to the operating voltage of the synchroscope.

With the connections as indicated and the "machine-starting" and "machine-running" plugs inserted in receptacles *B* and *C* respectively, it might be assumed in general that the oil circuit breaker of the "starting machine," generator No. 2, could be closed when the lamps were dark and the synchroscope pointer was at rest just over the mark at the upper part or top of its scale. This would be in accordance with the general method in use in the United States. It so happens, however, that it is not an unusual or exceptional occurrence to find potential transformers, even of the same make, with terminals wrongly marked for polarity or leads wrongly brought out of the case, so that the connections of the different transformers would not be symmetrical. This condition would give crossed connections which would cause the lamps to be bright at synchronism and the synchroscope pointer to take a position exactly 180 deg. away from its correct location, so that closing breaker No. 2 with the lamps dark and the pointer at the top of the scale might cause serious damage to either or both generators, or at the least a considerable disturbance on the system, since it is seldom, except in the smallest stations, that one finds generator breakers set for automatic operation.

To obviate any difficulty of such a nature a positive assurance of the correctness of the connections may be obtained by first disconnecting the leads of No. 2 generator at its terminal board, or at a point such as *A*, and then closing the oil circuit breaker No. 2. The conditions then existing will be the same as at synchronism, and the lamps will be either bright or dark and the synchroscope pointer will assume either an upper or lower position.

If the pointer comes to rest in the lower position and the lamps remain bright and it is desired to have the lamps dark, the leads of the potentional transformer of generator No. 2 should be reversed; if, however, it is desired to have the lamps bright at synchronism, the pointer of the synchroscope may be loosened on its shaft and shifted to its upper position. The No. 2 generator switch may now be opened, the leads reconnected and the machine put in service. While lamps are nowadays seldom used as a permanent synchronizing arrangement,



SYNCHRONIZING WIRING FOR TWO THREE-PHASE GENERATORS

they are usually an adjunct to a synchroscope, and the method described applies obviously as well when lamps alone are used for this purpose.

INSTALLATION OF MEASURING DEVICES HELPS GOOD FIRING

Recording Pressure Gage Assisted in Removing Laxity of Firemen, and Orsat Machine Helps Discover Air Leak

The one 550-hp. and two 410-hp. Edge Moor hand-fired four-pass boilers at the plant of the Iowa Falls (Iowa) Electric Company were being stoked in a more or less haphazard fashion when a new chief engineer was hired. The first thing he did was, in his own language, "to let things go blindly, as they had been going, to get a line on the firemen." This resulted in the discovery that firemen were piling a lot of coal into the furnaces, then sitting down leisurely while the steam ran up to the popping-off point and then dropped back 25 lb. or 30 lb. per square inch (1.75 kg. or 2.1 kg. per sq. cm.). At this stage they would "slug" the fire again. This was the cycle of operations day after day.

This resulted in the installation of a recording steam pressure gage. It required very little encouragement to create a friendly rivalry between shifts to see which could make the best charts. Now these same firemen have become so proficient that, with only an occasional glance at the chart, they keep the pressure range within 5 lb. per square inch (0.35 kg. per sq. cm.), which is very good for hand firing.

When this stage was reached the chief engineer, using a single Orsat machine, decided to look into the condition of the CO_2. The first samples taken from the first pass showed from 5 per cent to 6 per cent, indicating about a 35 per cent loss of fuel. The draft was then cut down over the fires and increased under the fires, and this showed a gain of 2 per cent in the

CO_2. While accurate draft-measuring instruments were not available, this procedure as a cut-and-try process was continued until the samples of CO_2 showed 13 per cent to 14 per cent and it was possible to carry the peak load without changing the draft. The draft is now about 0.3 in. (0.7 cm.) over the fires.

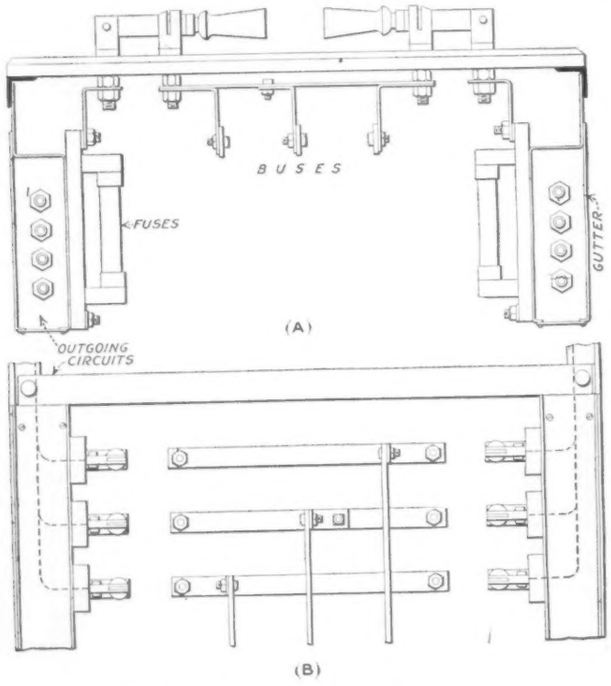
When the first pass showed this much improvement, samples were taken in the last pass. These showed 8 per cent CO_2. Experiments with the third pass gave the same results, showing that the baffling was all right. A search for air leaks was then started, which revealed a bad leak in the header. After this was stopped it was possible to get as high as 15 per cent CO_2. The boilers are now covered with a plastic cement which is very effective in keeping out air. On the whole, the plant is operating much more efficiently, owing to the installation and use of proper measuring instruments.

CONVENIENT ARRANGEMENT OF FUSES ON FEEDER PANELS

Fuses Are Mounted on Boxes Forming Side Inclosures of Rear of Panel—Details of Arrangement

BY H. BURT FOOTE

Considerable waste of space and an unsightly installation have usually been found to result from the design of feeder panels in which bus connections and fuses are a part. On several occasions the writer has found it necessary to design feeder panels for three-phase, 440-volt and 500-volt alternating-current circuits. As a result of some thought and consideration of the requirements the construction shown herewith has been



ARRANGEMENT OF FUSES AND DISTRIBUTION BOXES

worked out. Switches of 600-volt spacing in ratings of 30 amp. and 60 amp. combined with 600-volt fuses usually make an awkward arrangement.

Uniformity in the switches may be secured by using the 100-amp. size with 250-volt spacing, and this is also permissible for 600 volts alternating current and adaptable to circuits up to 50 hp. This switch possesses enough mechanical strength to adapt it to general use, which is not true of the 30-amp. and 60-amp. size with 600-volt spacing. Placing fuses on the front of a panel increases its size, making additional expense and a waste of space. As ordinarily placed on the back of a panel, they cover a portion of the studs and bus connections, making it difficult to tighten up a loose joint and inconvenient to get access to the outgoing feeders. These difficulties have been overcome, and the fuses are so placed that they bear a direct relation to the switches and that the connection from switch to fuse is reduced to a minimum.

The distribution boxes on which the fuses are mounted are made of sheet metal fastened as shown to the panel supports and forming a side inclosure for the back of the panel. The conduit enters them in a neat manner at top or bottom, and the wires are led direct to the fuse blocks through a bushed hole. Where more than one panel is used the adjacent boxes may be combined in one. The front-connection fuse blocks make them interchangeable for any size of circuit. The busbar construction will be found to be very simple and accessible.

ELECTRIC PUMPING COSTS IN MIDDLE WEST STATE

Bulletin Issued by the Iowa Engineering Experiment Station States that Such Pumping Is Most Economical

According to H. W. Wagner, mechanical and electrical engineer for the Engineering Experiment Station at Ames, Iowa, in bulletin No. 46, entitled "Electric Pumping, with Results of Tests and Operating Records," in most Iowa cities and towns the first cost of municipal waterworks is between $100 and $150 per connected service. This report is based upon data and experience obtained in co-operation with the Iowa Section of the N. E. L. A. and many operators of pumping plants.

Many towns with as small a population as 300 to 500 have public waterworks. Only in exceptional cases does the municipality receive sufficient revenue from the sale of water to pay all operating expenses and legitimate fixed charges. A large part of the waterworks investment is due to fire protection. "A careful study and analysis of the average problem," the author states, "indicates that, with a reasonable rate for energy, pumping by electricity results in a lower total of fixed charges and operating expenses than does pumping by any type of engine."

The following is a summary of the information contained in several tables in the bulletin:

	Approximate Average	Approximate Range
Single-stage pumping:		
Daily pumpage, gallons	260,000	40,000–1,000,000
Total head or lift, feet	155	14–305
Kw.-hr. per 1000 gal. (eigheen plants)	1.08	0.50–1.82
Rate in cents per kw.-hr	3.58	1.5–6.0
Double-stage pumping:		
Daily pumpage, gallons	66,000	25,000–135,000
Total head or lift, feet	300	150–525
Kw.-hr. per 1000 gal. (six plants)	4.39	1.16–9.00
Rate in cents per kw.-hr	3.15	1.7–5.0

The higher costs are in cases of the stage pumping when the air lift is used in the first stage.

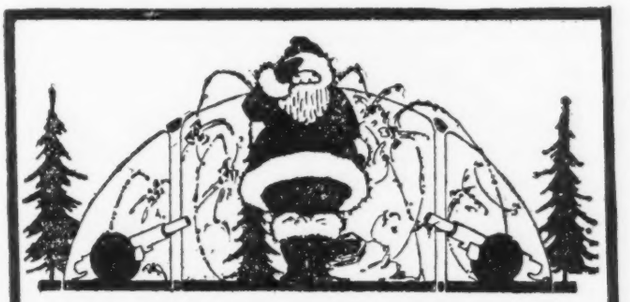
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

COMMENDABLE FEATURE FOR CENTRAL-STATION PUBLICITY

By Showing the Public the Way to Conserve Fuel Through Lighting Economy Government's Cause Is Helped

There seems to be a great opportunity to-day for the central station to emphasize in its publicity matter the service idea and how the electric lighting utilities can and do fit in with the government's war program.



Our Christmas War Message
Economize On Electricity

So serious is the coal situation that we ask our clients to help us—and by helping us, to help the Government—by lessening their consumption of electricity.

Electricity is such a blessing, and costs so little, the temptation is to be extravagant in its use

If everyone will use only what they actually need, the total amount saved will be considerable.

And be sure to keep your lamps clean and in good order that you may get full measure of service from the electricity you pay for

United Electric Light Co

EDUCATIONAL PUBLICITY ON HOW TO CONSERVE FUEL THROUGH SAVING IN LIGHT

One of the greatest problems the country now has to face as a result of the war is the coal situation. In this matter the lighting companies have a definite part to play in educating the public to the necessity for economy when it will tend to conserve fuel. It is recognized that a saving in fuel will result from the economical use of electric light.

Particular and concrete ways are open to the utility in this educational publicity. The use of small units in bathrooms, halls, etc., where a high degree of illumination is not required and the use of only such units as are necessary are two such ways. There is a third way on which considerable emphasis can now rightly be laid, and that is the elimination of the carbon-filament lamp. Using as it does about three times as much energy as the vacuum-type tungsten lamp, its waste of energy is considerable.

A CLASSIFICATION OF KILOWATT-HOUR SALES

Figures of Rochester Company Show the Relative Percentages of Total Sales Utilized in Different Types of Load

A classification of kilowatt-hour sales for 1916 has been made by the Rochester (N. Y.) Railway & Light Company, showing the sales to each industry. This classification shows that, aside from the energy sold to railways, which was 35.4 per cent of the total, the largest load was for miscellaneous industrial business, and next was municipal lighting.

BUSINESS CLASSIFICATION OF ROCHESTER COMPANY FOR 1916

Types of Load	Kw.-hr. Sales	Per Cent of Total
Apartment houses	405,366	0.337
Residences	4,224,457	3.510
Offices	710,493	0.590
Department stores	405,563	0.337
General corner-store lighting	5,937,616	4.925
Drug stores	329,214	0.273
Churches	251,501	0.209
Public garages	1,252,902	1.040
Private garages	352,881	0.293
Theaters	971,315	0.808
Eleemosynary institutions	208,298	0.173
Restaurants	644,522	0.535
Saloons	1,656,528	1.375
Hotels	1,515,226	1.260
Breweries	538,563	0.448
Printing establishments	824,345	0.685
Clothing manufacturers	1,155,358	0.960
Machine shops	4,571,574	3.800
Contractors	2,622,531	2.180
Cold-storage plants	874,144	0.726
Summer resorts	49,253	0.041
Bakeries	447,102	0.372
Shoe manufacturers	969,069	0.805
Candy manufacturers	288,886	0.240
Wholesale establishments	415,759	0.345
Woodwork	243,778	0.202
Manufacturing buildings	1,185,667	0.985
Stamping works	863,228	0.717
Greenhouses	20,411	0.017
Flour mills	203,560	0.169
Electric roof signs	52,093	0.043
Optical goods	2,997,363	2.490
Paper-box manufacturers	184,536	0.153
Colleges and private schools	76,638	0.064
Elevator service	90,396	0.075
Miscellaneous manufacturing businesses	10,847,799	9.020
Outside decorative lighting	161,509	0.134
Photo manufacturers	2,406,554	2.000
Public buildings	1,088,733	0.904
Clubs	473,873	0.396
Municipal lighting, general fund	9,013,204	7.490
Municipal lighting, additional	442,410	0.368
Fire boxes	118,280	0.098
Railroad corporations	4,356,823	3.620
New York State Railways	42,585,129	35.400
Electric corporations	8,356,188	6.950
Railroad & Lighting Company	2,936,802	2.440
	1,116	.....
Total kw.-hr.	120,328,556	100.00

PUBLIC IS NOW BUYING MORE EXPENSIVE ARTICLES

View Expressed that the Day of Going After the Small Appliance Market Is Past—Selling Sweepers Rather than Flatirons

An interesting point of view on the trend of the electric appliance market is voiced by William J. Barker, vice-president and general manager of the Denver Gas & Electric Company, in the January *Doherty News*. Mr. Barker says:

The day of going after the market for small appliances, like flatirons, is past and the public has been educated to the point where it realizes perfectly the advantages of electricity in the home and consequently is buying the more expensive articles. Sales aggregate a larger sum per sale than ever before. A striking instance is the recent Hoover suction sweeper campaign, during which 510 machines were sold, totaling $29,896, in a period of one month.

SALES OF WOOD WASTE PAY BILL FOR POWER

Little Rock Company Now to Make Effort to Connect Up Other Plants in Its Territory That Use Waste as Fuel

The Nowlin Lumber Company of Little Rock, Ark., which has an electric power installation of 125 hp. in motors ranging in size from 2 hp. to 30 hp., has just made an interesting statement to the Little Rock Railway & Electric Company. This company has been taking central-station energy for some time. In the past its very large amount of shavings and waste wood had been employed as fuel and there was no prospect of disposing of this by-product advantageously. Recently, however, Mr. Nowlin informed the lighting company that it had been successful in finding a market for this waste and that it is now selling enough of it more than to pay its entire bill for electric power.

On the strength of this the lighting company's commercial department is planning to make a special campaign among all industries which use wood waste or shavings, either partly or entirely, as fuel. The company believes that electric power offers unquestionable advantages in efficiency and naturally feels that it can safely undertake to find a market for the waste as a further inducement.

SELLING PREFERRED STOCK TO THE CITIZENS AT HOME

Portland (Ore.) Company Offers Its Securities to Residents of the Territory That It Serves and Its Own Employees

Under present financial conditions in the principal money markets of the country, the difficulty of securing funds is becoming a more serious matter every day to the utilities. One plan, however, that seems to produce results even when money is particularly tight is that of selling securities to the public in home territory.

Within the past three years a number of companies have tried out this scheme for raising funds, and in every instance, so far as records show, they have been more successful than was anticipated.

During the months of December and January the Pacific Power & Light Company of Portland, Ore., has carried on an active campaign for selling its preferred stock. The principal reason for this campaign, the company states, is to secure a greater distribution of stock among residents of the territories it serves and its employees. It says:

The interest of our customers and the employees of the company is mutual. Our growth and welfare is closely interwoven with the advancement of each and every one of the communities we serve. Each customer who is a stockholder, we believe, will take a more active interest in our company, and it is this interest that every large company wants and must have to be a success.

For a given amount of stock, a large number of holders are desired in preference to a few large stockholders. The importance of making this campaign is great. Every employee, whether in the office, a lineman, a meterman or a power-department man, we hope will do all within his power to do his part in actually selling the stock.

LARGE INCREASE IN USE OF ELECTRIC APPLIANCES

Shortage of Domestic Labor and Higher Wages Are the Important Factors in Bringing This About

During the year just closed the sale of electric domestic appliances showed a tremendous advance. Almost all utilities found it easier to sell these goods in 1917 than ever before, in spite of the higher prices. It is well known that the manufacturers enjoyed a much increased business.

There are a number of factors that have entered into this situation. The greatest probably was the growing scarcity of domestic labor. Many households found that it was virtually impossible to secure help, while, owing to the high wages demanded, others found it to be too expensive. Another factor in the increased purchase of appliances has been the better earnings received by the wage earners generally.

In this connection a few reports from the Byllesby utility companies are of interest, as follows:

A total of 13,545 electrical appliances were placed on the Minneapolis General Electric Company's lines during the period from Jan. 1 to Nov. 1, 1917. Electric flatirons were the most popular of all devices sold, the total numbering 4601. Electric vacuum cleaners were next, the total being 3091. The other appliances in the order of number of sales ranged as follows: Toasters, 987; washing machines, 612; heating pads, 401; grills, 384; curling irons, 343; percolators, 324; ranges, 223; air heaters, 214; vibrators, 154; water heaters, 138; luminous radiators, 96; chafing dishes, 85; hot plates, 84; miscellaneous, 1807.

The compilation is interesting also from the standpoint of showing which months were the most popular appliance months. It indicates that May and September for 1917 at least were the heaviest ones in this respect, although August and November follow closely. January was the poorest month for appliance sales, owing no doubt to the fact that this month follows immediately after the holiday appliance campaign.

Without any special effort the Oklahoma Gas & Electric Company and the dealers of Oklahoma City were successful in selling 855 electric household appliances during the months of September, October and November. The list includes the following: Vacuum cleaners, 305; flatirons, 240; heaters, 91; curling irons, 48; toasters, 35; grills, 35; washing machines, 25; percolators, 24; heating pads, 18; sewing-machine motors, 15; water heaters, 10; fans, 9.

At San Diego, Cal., 3734 appliances were sold in the first ten months of the year. At Mobile, Ala., 1311 were sold in the same period. At Louisville, Ky., 3222 were sold. At Stockton, Cal., 2406 were placed on the company's lines through combined efforts of the company and the dealers.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Rational Theory of Closed Windings.—A. ILIOVICI.—A study of the theory of drum windings independently of ring windings, containing simple formulas and a new presentation of the subject applicable to all sorts of windings.—*Revue Générale de l'Electricité*, Dec. 1, 1917. (Abstracted from the *Bulletin de la Société Internationale des Electriciens.*)

The Electrical Generating Plant of Larderello.—P. GINORI-CONTI (*Elettrotecnica*, Sept. 15 and Sept. 25, 1917).—This plant utilizes the natural heat of volcanic steam jets for heating steam-generating boilers driving turbo-electric generators. The energy generated by this installation is furnished to the principal electricity-distributing companies of Tuscany. The favorable results obtained have encouraged the proprietors of the "soffioni," as the volcanic steam jets are called, to extend them. Investigations are being made for this purpose, the direct application of the natural steam to the driving turbines having been decided on. Many illustrations and numerous details of construction are contained in the article.—*Science Abstracts*, Section B, Nov. 30, 1917.

Lamps and Lighting

Control of Lighting.—By an order dated Dec. 24 the Ministry of Munitions has obtained extensive powers with regard to the control of lighting. The ministry may, "with a view to maintaining or increasing the supply of light, heat or power for the purpose of production, repair or transport of war material, or any other work necessary for the successful prosecution of the war, by order direct that lights of any specified class or description shall be extinguished or their use restricted to such extent, between such hours, within such area on such premises, and during such period, as may be specified in the order, and if any person having control of any light or occupying, or having control of, or managing, or being in charge of premises in or in connection with which any light is used, acts in contravention of any such order, he shall be guilty of a summary offence against these regulations."—London *Electrician*, Jan. 4, 1918.

Ideals and Near-Ideals in Lighting Units.—HAROLD W. BROWN.—The author brings out some of the important features which should be embodied in lamps and reflectors. Among them are amount of light, distribution of light, invisibility of the filament or other source, diffusion of light, diffusion of illumination, color of light, low cost of the unit, efficiency of the unit, durability of the unit and ease of cleaning.—*National Electrical Contractor*, January, 1918.

Historical Lighting of Independence Square, Philadelphia.—E. F. KINGSBURY.—The paper describes the new historical lighting recently installed in Independence Square. The units are described in detail and several photographs of different units are shown. Considerable material of historical and educational interest is included, descriptive of early lighting installations in Philadelphia after which the equipments were copied.—*Transactions of Illuminating Engineering Society*, Dec. 31, 1917.

Generation, Transmission and Distribution

Determining Stray Power of a Transmission Line.—D. D. EWING.—In transmission lines operating at very high voltages, 60,000 or higher, losses over the insulators and through the atmosphere assume formidable proportions. These losses, or rather the cost of mitigating them, form a considerable factor in limiting the voltage. At high altitudes the loss is very serious, owing to the rarefaction of the air, which loses its insulating properties at low pressure. In this article the author presents the results of some studies conducted on an electric railway line in the Middle West. With the comparatively low voltage of 33,000 volts used on the line tested, the leakage losses are not serious, but the results clearly illustrate the principles involved.—*Electric Railway Journal*, Jan. 12, 1918.

Steam Turbines.—A symposium which describes different types and classifications of turbines, including vertical, horizontal, single-flow and double-flow, bleeder, mixed-pressure, exhaust and reversing turbines. Piping systems for various turbine arrangements, determination of proper sizes and shapes of turbine nozzles, blading, turbine wheels, blade rings, governors, cylinders and foundations are taken up. The effects of variation in steam pressure, superheat, vacuum and size upon economy of steam turbines are also discussed.—*Power Plant Engineering*, Jan. 1, 1918.

Air Pumps and Condensers.—A new application of the steam jet to vacuum production has recently been suggested by D. B. Morison. From the experiments carried out it appears that if a 25-in. or 26-in. (63.5-cm. or 66.0-cm.) vacuum will satisfy requirements, this can be obtained more cheaply and maintained more certainly by the use of auxiliary steam jets than in any other way. By interposing steam jets between the condenser and the pump, these jets, which, as is well known, have a great volumetric capacity, compress the air into the pump suctions, so that a large weight of air can be abstracted with a very moderate pump displacement. The great advantage of this in the present shortage of brass and other copper alloys lies in the fact that the amount of cooling surface in the condenser can be reduced 20 per cent to 25 per cent without loss of vacuum, and the air pumps may also be much smaller than is called for in ordinary standard practice.—London *Engineering*, Dec. 21, 1917.

The Aluminum Transformer.—M. VIDMAR (*Elektrotechnik u. Maschinenbau*, July 8, 1917).—Scarcity of copper has led to the construction of transformers with aluminum windings, but the author contends that it is possible even in normal times to build air-cooled trans-

formers cheaper and lighter if aluminum be employed instead of copper. The ratio of the prices of insulated aluminum and copper wire is taken as 1.4: 1.0. In the most economical design of transformer with copper windings it is necessary to leave considerable spaces between the coils in order to obtain adequate cooling. When aluminum windings are used this space can be conveniently reduced without prejudice to the temperature rise. Owing to the relatively greater proportion of the cross-section of the coils which is occupied by metal, the difference between internal and external temperatures is less with aluminum windings than with copper. The difficulty of making joints in the winding is rather serious. An example of an aluminum design is given—a 100-kva. transformer which has been built by the author.—*Science Abstracts*, Section B, Nov. 30, 1917.

Installations, Systems and Appliances

Power-Plant Installations for By-product Coke-Oven Plants.—GEORGE B. EVANS.—Factors taken into consideration when designing the power plant for the St. Louis By-product Coke Plant. The author calls attention to the types of drive and control desirable for such plants and the purposes for which steam is required. Three methods of securing the energy for operating such a plant are discussed and reasons are given for selecting the equipment used in the St. Louis plant. The electrical and steam demands on this plant are tabulated, the latter indicating that the cost of the power house would not have been much less if no electrical machinery had been installed.—*Journal of the Engineers' Club of St. Louis*, November-December, 1917.

Condenser for Power Circuits.—Description of commercial method of making static condensers for power circuits. It is said that the losses in these condensers are only about 0.3 per cent. For any particular frequency the capacity required to give a definite output in kva. varies inversely as the square of the voltage. At very low pressures—that is, less than 660 volts—the kva. output can be increased by using inductances in series with the condensers, thus increasing the pressure across them. In one case cited, furnishing 100 leading kva. to a 200-volt circuit at 50 cycles, 64 per cent less capacity is required by inserting inductances raising the voltage across the condensers to 550 volts. A chart is included indicating the amount of capacity required per kilowatt of load to raise the power factor from any value to any other value.—London *Electrician*, Jan. 4, 1918.

The Modern Cargo Crane.—CLAUDE M. TOPLIS.—The relative advantages of the electric, steam and hydraulic types of crane are first outlined and typical designs are briefly given. For the handling of cargoes speed is of first importance, and therefore this desideratum should be borne in mind in the equipment that is provided. Details are described for giving the various motions—hoisting, slewing and luffing—and reference is made to the wear of ropes.—London *Electrician*, Dec. 14, 1917.

Power-Plant Instruments as an Investment.—M. A. SALLER.—Seventh installment of a series on this subject. This particular article dwells on the benefits to be derived from the use of steam-flow meters.—*Power Plant Engineering*, Jan. 15, 1918.

Wires, Wiring and Conduits

Determination of Size of Wire for a Lighting Circuit.—HAROLD W. BROWN.—The author points out that it should be remembered that three matters are to be considered with reference to determining the best sizes of electrical conductors, unless past experience has shown that some of them can be omitted: (1) The wires should be strong enough for safety to life and property; (2) they should be of such size that the total annual expenses chargeable to the line are not excessive; (3) they should be large enough so that the line drop is not excessive. The author gives a simple method for finding the best size wire to use, taking into account the three above points.—*National Electrical Contractor*, January, 1918.

Electrophysics and Magnetism

Electrometallic Influences Exerted Across Very Thin Insulating Substances.—EDOUARD BRANLY.—A paper read before the Académie des Sciences recounting experiments made with a leaf of mica between 0.004 mm. and 0.005 mm. in thickness, where the lower disks were of pure silver and the upper disks in three different experiments were respectively of pure silver, of platinum of 32 mm. diameter, and of cobalt. The author concludes by saying that if unipolar conductivity does not in itself have much theoretical interest, it leads to the knowledge that metallic surfaces of different natures placed opposite each other exercise a specific exterior influence upon the intermediary substances under the influence of even a feeble emf. at distances great enough to be measured directly.—*Revue Générale de l'Electricité*, Dec. 15, 1917 (abstracted from *Comptes Rendus des Séances de l'Académie des Sciences*).

A Graphical Method for the Construction of Electrostatic Fields.—SYLVAN J. CROOKER.—A graphical method is explained which permits the construction of any electric field, or the solution of La Place's differential equation. As an example, the field for a thin wire strung through a circular hole in an infinite plane is given. This field is representable by $w = \cosh Z$.—*Journal of the Franklin Institute*, January, 1918.

Wet Condenser Suitable for Continuous High-Potential Service.—One-liter Pyrex glass beakers containing a nearly saturated solution of common salt were immersed to a similar depth in a solution contained in an earthen vessel. The place subjected to greatest danger of puncture and that which allows greatest leakage is where the exposed surfaces of the solution inside and out come in contact with the surface of the beakers. The effect can be reduced considerably by filling the beakers to a slightly different level from that of their containers. Care should be taken not to wet the portion of the beaker that is not immersed. To eliminate sparking the surfaces of the solution inside the beakers and that surrounding the beakers were covered with a layer of oil 5 cm. deep. For this purpose a 300-deg. mineral seal oil was used. The capacity of these condensers was estimated at 0.0092 mfd. A similar estimation of the capacity of two such beakers covered with tinfoil indicated that their combined capacity was very appreciably less than two beakers of the wet condenser. The capacities were 10 per cent higher using mercury than when using the salt solution.—*Science*, Jan. 4, 1918.

Condensers (electric)

Units, Measurements and Instruments

Electrical Resistance of the Human Body.—Results obtained from measuring the resistance of the human body to electric currents vary from 500 ohms to 8000 ohms and even more. According to a note by Dr. Nixdorf of Berlin, appearing originally in *Elektrizität* of that city, these enormous differences are due to the employment of defective methods. When an excessive continuous voltage is used muscular contractions and nervous excitations ensue which falsify conclusions. Experiments made by Dr. Nixdorf and Professor Brandenburg have brought consistent results. They used both direct and alternating current—in the first case at 1 millivolt, corresponding to the action of the heart; in the second case replacing the slide-wire of a Wheatstone bridge by a trough filled with a solution of sulphate of zinc. The subject plunged his arms or his legs into salt water at the temperature of the human body and resistance was measured between the arms, between the legs and between one arm and one leg, the experiments being repeated after two weeks' time. The results are tabulated as follows:

	Resistance to Direct Current, Ohms		Resistance to Alternating Current, Ohms	
	Arm to Arm	Leg to Leg	Arm to Arm	Leg to Leg
Healthy countryman (59 years)	1100	1400	233	350
Woman with nervous malady	1000	1200	255	455
Diabetic patient	1500	1700	284	434
Man (65 years) while in attack	2000	3100	224	414
Man with softening of brain	1800	2800	299	414
Ditto	1400	1400	270	480

When the subject was apprehensive the resistance, measured with direct current, was found to be greater than when he was tranquil, 1700 ohms from arm to arm and 1500 ohms from leg to leg being recorded in the first state and 1000 ohms from arm to arm and 1200 ohms from leg to leg in the second state.—*Revue Générale de l'Electricité,* Dec. 1, 1917.

Standardizing Methods of a Modern Utility.—WILLIAM F. JOHNSON.—Description of the testing facilities of the Philadelphia Electric Company's standardizing laboratory. The policy followed in conducting tests is outlined.—*Journal of the Engineers' Club of Philadelphia,* January, 1918.

Telegraphy, Telephony and Signals

New Results on Testing Telephone-Switchboard Cables.—F. LANGE (*Elektrotechnische Zeitschrift,* Sept. 6, 1917; communication from the German Telegraphs Experiment Station).—With regard to the design of cotton and silk cable, two points especially need to be considered: (1) Limitation of space, (2) absorption of moisture by the insulating material. The first is met by making the cables flat and ribbon-shaped. In connection with the second, twin leads of 0.6, 0.5 and 0.8 mm. section, having capacities in the ratios 1 : 0.82 : 1.62, showed leakage in the proportion 1 : 0.72 : 2.1. Cable soaked in beeswax was very much less influenced by atmospheric moisture than any of the other cables tested; the core had been insulated in the usual manner, dried in vacuum and plunged into hot beeswax, the whole being covered with cotton braiding.—*Science Abstracts,* Section B, Nov. 30, 1917.

Miscellaneous

Notes on the Electric Equipment of Machinery for the Handling of Materials.—Continuation of an article on the same subject. In this part a number of points are discussed in regard to what may be termed the details of electrical equipment. These include motors, speed regulations, electric braking, controllers, resistors and switchgears.—London *Electrician,* Jan. 4, 1918.

Hydroelectric Energy as a Conserver of Oil.—H. F. JACKSON and F. EMERSON HOAR.—Possibilities of further conservation of California petroleum by the more extensive and efficient utilization of hydroelectric energy that can be made available by the interconnection of the more important transmission systems.—*General Electric Review,* January, 1918.

Life of Impregnated Wooden Poles.—F. MOLL.—An article giving the results of treating wooden poles as they have been worked out in Europe and America during many years. The average life of treated poles, according to the statistics of the telegraph administrations, follows: Unprotected poles, five to seven years; poles covered with a coat of carbolineum, six to eight years; poles impregnated with chloride of zinc, twelve years; poles impregnated by the Boucherie process (sulphate of copper), fourteen to fifteen years; poles impregnated with sublimate (cyanization), seventeen years; poles impregnated with oil of goudron, twenty-three to twenty-five years.—*Revue Générale de l'Electricité,* Nov. 24, 1917.

Book Review

EMPIRICAL FORMULAS. By Theodore R. Running. New York: John Wiley & Sons, Inc. 144 pages, illustrated. Price, $1.40.

The subject of empirical formulas is not of great importance in pure mathematics, and perhaps that is why its literature has never been greatly developed. In applied mathematics generally, and in engineering particularly, empirical formulas are often very important, because when a graphical relation has been established between two or more physical quantities it often becomes very desirable to discover what laws may be represented by that relation. A step in the process of discovery may be the determination of an empirical formula applying to the case. The author has made a distinct contribution to this important subject, especially from the standpoint of technology. The subject matter is divided into eight main chapters relating to topics that may be expressed as follow: Arithmetical series, arithmetical-series exponentials, geometrical series, special series, periodic series, least squares, interpolation, integration. The order of development is clear and logical. The text is abundantly illustrated by curves and graphs, which lend great assistance in the comprehension of the subject matter. The book will be found to be of very considerable value not only to the practising engineer and to engineering and technical students but also to all mathematically trained observers interested in its subject.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

CONFERENCE CLUB TALKS ON ADJUSTMENT OF WAGES

"Adjust Wages Periodically on Basis of 'Index Numbers' Showing Increase in Cost of Living," Proposed by L. K. Comstock

The Conference Club, the organization of the large electrical contractors doing an interstate business, met at Asheville, N. C., on Jan. 17 to 19. The feature of the program was an epochal paper on a plan for the automatic adjustment of the wages of labor by L. K. Comstock of L. K. Comstock & Company, New York.

Mr. Comstock's proposal related to the periodic adjustment of wages on the basis of the "index numbers" compiled by various authorities showing the rise in the prices of commodities that make up the cost of living. Mr. Comstock presented curves illustrating the close agreement of the index numbers, covering the last eighteen years, variously and separately compiled by Bradstreet, Dun, Gibson and the Department of Labor.

Assuming that three-quarters of the wage earner's outlay for the necessities of food, clothing and shelter follows the trend of these index numbers, Mr. Comstock suggested that if, for example, the accepted index number for April 1, 1917, was 190 and it rose to 220 by Oct. 1, 1917, an increase of 15 per cent, a corresponding increase should be granted on three-quarters of a given worker's wage.

Thus an electrical worker receiving $5.20 a day April 1, 1917, would be entitled to an increase of 15 per cent on three-quarters of $5.20 ($3.90), or a cash increase of 60 cents a day, making his readjusted wage as of Oct. 1, 1917, $5.80 a day. Such adjustment would preserve his relative earnings unchanged, compared with the rising cost of living.

Such a plan of adjusting wages has the merit of immediate practicability, declared Mr. Comstock. For years the United States Department of Labor has compiled and published an index number which would serve every purpose, while having the stamp of authority. The plan might be started by arbitrarily accepting wages now prevailing in each locality as the local base rate.

Employer and Mechanic Need Each Other

Mr. Comstock's proposal for scientific wage adjustment was introduced by a comprehensive review of the conditions surrounding the relation of employers and labor. He urged that both employer and mechanic frankly admit that neither can get along without the other and asked that, making a virtue of necessity, the employer study sympathetically the needs and requirements of his men, and likewise that the union see to it that its men work faithfully and sympathetically for their employers.

E. E. Van Cleef of L. K. Comstock & Company, Chicago, read a paper on "Co-operation with Labor." He urged franker confidence between employer and mechanic, in the knowledge that their larger interests are identical. Mr. Van Cleef declared that much of the destructive "cheap" competition suffered by the reputable contractor would be avoided if electrical unions recognized that their best interests are served when electrical labor is secured through the electrical contractor. He urged further that the unions aid in correcting the situation by opening their doors to non-union workers who apply.

William L. Goodwin, New York, spoke on the desirability that the electrical contractors take trade acceptances from customers as well as give them in payment of purchases. Giving trade acceptances is evidence of ability to pay, said Mr. Goodwin, and he urged particularly that the strong companies put the acceptance plan into operation at once, even partially.

Construction Cantonment Situation in Washington

The construction contract situation in Washington was presented in a report by Sullivan W. Jones.

It was shown that the lack of uniformity in these policies, the absence of co-ordination of departmental activities, the efforts of departments to preserve their prerogatives, the inherited prejudice against exchange of opinion and data between departments, had led to the overlapping of programs, confusion, congestion in the material market and delay. This phase of the situation was developed quite fully, although, as Mr. Jones said, many of the Conference Club members were familiar with it, because it suggested its own cure—the centralization of control and the adoption of a uniform policy.

The order issued by the Secretary of War on Nov. 5 transferring the control of all army construction work to the cantonment division of the Quartermaster's Department and the appointment of General Goethals as acting quartermaster general were pointed to as steps taken to effect such centralization. The belief was expressed that the government must and would undertake shortly the purchase of all materials required, in order to provide scientific distribution of work and fullest utilization of all forces of production.

The contractor, Mr. Jones stated, is an instrument of production, and the application of the same policy of control to the actual work of construction would unquestionably lead to a change in relations between the government and the contractor. It was prophesied that the time is not far distant, if the war continues, when the contractor as well as the manufacturer will come under government control and will be employed as an expert in a professional capacity for a stipulated fee, which would probably have no relation to the cost of the work.

L. K. Comstock was re-elected president of the Conference Club, W. C. Peet was re-elected treasurer, and Sullivan W. Jones was appointed secretary.

CONTRACTORS' ORGANIZATION IS LAUNCHED IN ST. LOUIS

W. C. Peet Is Elected First President of the New National Association of Electrical Contractors and Dealers

Representing twenty-two state associations of electrical contractors which adopted the plan of organization approved at the New Orleans national convention last October, members of the executive committee of the new National Association of Electrical Contractors and Dealers met at St. Louis on Tuesday, Jan. 22, and formally launched the organization.

Past-president Robley S. Stearnes, New Orleans, was elected temporary chairman, and after submitting his presidential report with suggestions for the new association in 1918 he appointed a nominating committee headed by J. A. Fowler, Memphis.

Reporting later in the day, Chairman Fowler paid a

PRESIDENT W. C. PEET

tribute to the untiring efforts and personal sacrifices of President Stearnes in bringing the association through the reorganization period, but declared the belief of the nominating committee that it would be necessary to choose a 1918 executive from New York City, the center of activity of other branches of the electrical industry with which the contractors will have to work. The nominations of the committee were:

President, W. C. Peet, New York; treasurer, Earnest McCleary, Detroit; secretary, Harry C. Brown. These officers were unanimously elected later.

On motion of Fred Adams, St. Louis, it was voted to move the association offices temporarily to New York in order that the president and secretary might work to closer advantage during the organization period. Authority was also given to hire an assistant secretary to handle routine work, leaving Secretary Brown free for broader executive duties in initiating a great membership campaign.

At the banquet tendered the executive committee by the St. Louis contractors J. A. Fowler acted as toastmaster, and there were addresses by W. L. Goodwin, James R. Strong, Earnest McCleary, Robley S. Stearnes and Chairman-elect W. C. Peet.

W. Creighton Peet, the new national chairman, is a well-known electrical contracting engineer of New York City. Born in New Orleans in 1871, he was educated at the Massachusetts Institute of Technology, later taking diplomas from Heidelberg and Darmstadt. He carried on engineering work for Schuckert & Company, Nuremberg, and, returning to America, joined the engineering staff of the American Telephone & Telegraph Company. Later, with Mr. Powers, he formed the electrical contracting firm of Peet & Powers, which handles large electrical construction work. Mr. Peet is also treasurer of the Conference Club and of the Institute of Electrical Contractors of New York City and has been the representative of the National Contractors' Association on the National Electrical Code committee.

WORK OF MANUFACTURERS OF WIRE AND CABLE IN WAR

Co-operating to the Fullest Degree to Meet the War Requirements of the National Government in Quick Time

A dinner-meeting of the wire and cable manufacturers who are co-operating in war service work for the government was held at the Yale Club, New York, on Jan. 17. Sixty-two men were present. The list of companies represented comprised forty-six properties in different parts of the country, and all are available for work for the government in prosecuting the war.

The large movement to further the war which culminated in this meeting had its beginning with the organization of the wire and cable committee as an outgrowth of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies. Le Roy Clark, Safety Insulated Wire & Cable Company, who presided at the meeting on Jan. 17, is the chairman of the Wire and Cable Section of the Associated Manufacturers of Electrical Supplies and became in turn the chairman of the wire and cable committee and then of the wire and cable group which has now been formed in connection with the General War Service Committee of the Electrical Manufacturing Industry.

The organization which is now being carried intensively into every branch of the electrical manufacturing industry will, it is hoped, include all manufacturers without regard to whether or not they are members of the associations in the industry.

Mr. Clark explained the purpose of the organization to serve the government by providing necessary manufacturing capacity to meet requirements of the federal authorities in the quickest possible time. Complete coordination and patriotic co-operation are yielding the results desired by the Washington authorities. The wire and cable group has already been instrumental in supplying millions of feet of the various kinds of cable and wire requested by the government.

Robert K. Sheppard, Simplex Wire & Cable Company, chairman of the General War Service Committee of the Electrical Manufacturing Industry, made a stirring patriotic address and showed clearly how the organization of manufacturers in the national interest is an effective and necessary part in the prosecution of the war to a successful peace.

Thorough sympathy with the objects outlined was expressed by others present.

General Compliance with Garfield Order

Regulation Designed to Relieve Railroad Congestion Causes Sharp Curtailment of Power Consumption and Some Saving of Fuel—Reports from Central Stations Show Necessity of Drastic Action in Some Cases

LACK of co-ordination in the work of the Fuel Administration and of the Director General of the Railroads has made it impossible to realize great saving from the order of Dr. Garfield.

It develops from interviews with the Fuel Administration that the chief purpose of the order was to relieve congestion on the railroads. Industries supplied with electrical energy generated from water power were shut down for the purpose of curtailing production which might add to the already serious freight congestion. Yet freight kept piling up from points west of the Mississippi, so that the congestion at this writing is as bad as ever. While it is true that shipping in New York Harbor received some coal, the scarcity because of lack of motive power on the part of the railroads coupled with adverse weather conditions is more acute.

At the end of the five-day restriction period no official could say on Wednesday just what were the effects of the industrial shutdown except that it had got coal to seaboard for ships. On Tuesday night the Fuel Administrator requested an embargo on all freight except food and fuel for the remainder of the week so as to obtain the maximum good from his previous order, and on Wednesday Director McAdoo issued the following statement:

> On account of the extremely severe weather, which has particularly affected operations of railroads crossing the Alleghany Mountains, Director General McAdoo, upon the recommendation of Regional Director Smith, has authorized him to place an embargo upon all freight except food, fuel and such war munitions and war supplies as are specifically approved by the War Department upon the Pennsylvania Lines east of Pittsburgh, the Baltimore & Ohio east of the Ohio River, and the Philadelphia & Reading, for the purpose of enabling these lines, which are the heaviest bituminous coal carriers, to continue specializing upon coal for the double purpose of supplying the acute conditions in New England and the harbor of New York and elsewhere and in the provision of empty cars for mines and coke ovens. This embargo is a temporary one. It should last but a few days if the weather moderates.

It will be noted that the length of time the embargo is to be in force is indefinite, depending on the weather.

Reports to the ELECTRICAL WORLD from different parts of the country show that the percentage of curtailment in power consumption varied widely in individual properties. In many cases the sharp reduction on the first day was modified on succeeding days as more and more industries were exempt. The effect of the order was to bring relief to various central stations in which drastic action had become necessary.

Many electrical manufacturing companies engaged in war work were exempt in whole or in part.

The reports to the ELECTRICAL WORLD of central station conditions follow:

APPALACHIAN POWER COMPANY

The effect of the order of the Fuel Administration is to reduce our output approximately 20 per cent. The reason that we are not more affected by the order is that the majority of our load is consumed in the mining of coal, the mines, of course, being operated as near full capacity as possible in so far as the labor and car supply will permit.

HYDRAULIC POWER COMPANY, NIAGARA FALLS

Practically all Niagara Falls plants are operated entirely by hydroelectric power, except a few that use coal for purposes of drying product, and it is apparent that continuous twenty-four-hour operation of plants on water-power systems will aid conservation of coal.

Our estimate of work shut down here on account of the Fuel Administrator's order is not in excess of 10 per cent.

We believe this to be a grand and absolute demonstration of the superiority of hydroelectric power over coal power in that it does not make demands on the transportation systems of the country in times of crises similar to the present one.

PENNSYLVANIA WATER & POWER COMPANY, BALTIMORE, MD.

The Pennsylvania Water & Power Company, being engaged only in the generation and high-tension transmission of hydroelectric energy, is not affected, as an operating company proper, by the recent order of the Fuel Administrator.

The Pennsylvania Water & Power Company supplies through independent local distribution companies the larger portion of the electric railway, lighting and power requirements of the cities of Baltimore, Md., and Lancaster, Pa., and their vicinities. The remaining portion of the Baltimore load requirements, which is supplied by steam, comes within the scope of the Fuel Administrator's order.

Present indications are that the power reduction of the combined system is approximately 15 per cent during the day. We expect that the cities of Baltimore and Lancaster, being two of the few cities in the East connected with a large hydroelectric system, will continue to be much less affected by present or future orders for restriction.

NIAGARA FALLS POWER COMPANY

Practically all of our output is delivered to public utilities and to electrochemical and electrometallurgical industries operating continuous processes, whose plants or their contents would be damaged by shutting down. We understand that customers are observing the Fuel Administration order and are either discontinuing or curtailing to the lowest limit the use of fuel for heating and other incidental purposes. The demand for our output is so great that any power whose use is discontinued is immediately taken up elsewhere. The order, therefore, has no effect on the quantity of our output, although it may have a very slight effect on the distribution thereof.

TENNESSEE POWER COMPANY

There are quite a number of textile mills operated by our power. These mills require heat for dyeing stock and for heating buildings. Some of them have shut down. Others are burning wood for such heat under temporary authority of the State Fuel Administrator; others are heating their building to approximately 40 deg. in order to avoid freezing, as permitted by general order, and allowing help to work or not as they see fit at this temperature.

Foundries are practically out of business, and other manufacturing is either partially running or wholly shut down, so that it is utterly impossible for us to make any intelligent estimate as to the effect on our system. We, of course, expect a considerable reduction in load during both the five-day and the ten Monday periods, but it is impossible to tell what this will be.

DETROIT EDISON COMPANY

Effect of the Fuel Administration order is to cut our daily output approximately 500,000 kw.-hr., or say 23 per

cent of output on week days except Saturdays. Fuel saving approximately 500 tons per day.

DAYTON (OHIO) POWER & LIGHT COMPANY

Effect of Fuel Administrator's order reduced load on generating stations approximately 60 per cent on Friday and Saturday, with slightly increased load on Monday.

CLEVELAND ELECTRIC ILLUMINATING COMPANY

Situation from our standpoint demanded drastic action. First day's order reduced load 50 per cent.

ROCHESTER RAILWAY & LIGHT COMPANY

As a result of the fuel order we are saving about 250 tons of steam coal per day in our electric plant and approximately 50 tons of coal and 2500 gal. of oil in our gas plant. The order is being lived up to in a way which is commendable to the citizens of Rochester and, if the people of this city represent the nation, the spirit manifested can mean but one thing, and that is that the war will be won.

We believe that the relief to the railroads will do much to help clear up transportation difficulties.

American Citizens Will Obey the Order

Because hospitals, charitable institutions, municipal lighting, etc., are not affected by this order, gas, electricity and steam will be on our lines as heretofore. If you are in doubt as to how the order affects your business, 'phone "Bell, Main 3960, or Home, Stone 3960" and ask for any of the following representatives of this company:

R. M. SEARLE	E. L. WILDER
J. T. HUTCHINGS	J. P. MacSWEENEY
H. RUSSELL	E. C. SCOBELL
T. H. YAWGER	F. W. FISHER
I. LUNDGAARD	C. A. TUCKER
	C. G. DURFEE

Any of these men will gladly conserve your time by securing for you a ruling from the local fuel administrator.

Orders for the shutting off of light, heat or or power resulting from failure to obey the new order will be executed promptly by this Company.

Our Attitude

The order has been issued to relieve present suffering and prevent still greater distress. These conditions have been brought about by the war which must be won.

The order means financial loss to all—This is our opportunity to prove that we are first of all American Citizens.

Let's Do Our Duty Cheerfully

HOW THE ROCHESTER COMPANY TOLD THE PUBLIC

MAHONING & SHENANGO LIGHT & RAILWAY COMPANY, YOUNGSTOWN, OHIO

On Friday output was reduced 105,000 kw.-hr., or 19 per cent; load reduced 6800 kw.-hr., or 23 per cent. On Saturday output reduced 94,000 kw.-hr., or 19 per cent; load reduced 5400 kw.-hr., or 19.6 per cent.

ROCKFORD (ILL.) ELECTRIC COMPANY

The effect of the Fuel Administrator's order has been that we are reduced to 40 per cent of our normal load; also that window and sign lighting has been discontinued to even a greater extent than that required by the Garfield order.

People here are intensely patriotic and wish to aid the government in its conservation of fuel.

LOUISVILLE GAS & ELECTRIC COMPANY

On Friday, Jan. 18, the output of electricity from our plant was 169,500 kw.-hr. against 219,000 kw.-hr. for an ordinary day. The peak load was 14,800 kw.-hr. against 16,000 kw.-hr. for an ordinary day. The loss in output was almost entirely confined to the daytime hours, when the factories that formerly used electric power were not running.

MILWAUKEE ELECTRIC RAILWAY & LIGHT CO.

The order of the Fuel Administrator has caused a reduction in our power load of approximately two-thirds, but has had no noticeable effect on our lighting load. Reduction in railway load is very small. The operation of the order will cause a substantial decrease in gross revenues, with the only offsetting reduction in operating expenses represented by coal equivalent to the kilowatt-hours saved. The effect on net income will be serious. Measured in this way, the cost of saving the coal will exceed its value.

EDISON LIGHT & POWER COMPANY, YORK, PA.

There was a marked decrease in our output for the five days, and particularly on Monday. During the period we were able to operate on water power entirely, the only fuel used being that required for our steam-heating system. We have not benefited in the distribution of coal, but hope that the effect of the order in partially relieving the railroad congestion will result in a general improvement and at least prevent a complete tie-up.

WHEELING (W. VA.) ELECTRIC COMPANY

We will naturally suffer some loss of revenue, but as fuel conditions were getting desperate (in fact, we were anticipating daily the necessity of cutting off our power customers) the order worked to our advantage, permitting the storage of some fuel, which has not been done for two months, our storage being completely exhausted.

A number of our large power customers were permitted to operate, and in addition to these we are furnishing power for thirty coal mines, which, of course, are working.

Our power load loss for the days affected by the order will be about 50 per cent, but in the end we estimate that the loss will not be nearly so large because we believe the railroad situation will be relieved, permitting a number of our works to operate full, while at present some of them are closed down and others are working part time on account of their inability to get raw material in and finished products out.

The coal mines we are supplying power to are located in Ohio, which accounts for the difficulty of getting fuel from them. We do not have a shortage of fuel mined in this vicinity. The railroad sidings are full of coal. Hundreds of cars can be found on the railroad sidings that have not been moved for days and in some cases weeks.

Sharp Curtailment in Output in New England

Many New England central stations lost one-half to three-quarters of their day loads during the period covered by the Garfield order, but the situation improved as exemptions were announced in Washington. It is estimated that 1,200,000 factory workers were idle on Friday, but there was patriotic compliance with the order despite hardships. The amount of wages lost in thirteen idle days is estimated at $38,000,000.

The peak load of the New England Power Company fell from 65,000 kw. to 25,000 kw. The company wasted no water and its reservoir system proved most valuable. This company expects that its load will increase on future Mondays through the exemption of war industries from the operation of the order.

The Turners Falls Power Company and other hydroelectric companies were authorized by the State Fuel Administrator to supply customers with water power.

It is understood that the effect of the order was not disastrous in the territory of the Edison Electric Illuminating Company of Boston.

There was a substantial reduction of load at Providence. The interconnection with the New England Power Company's system proved most valuable.

The Cumberland County Power & Light Company,

Portland, Me., met the load entirely with water power. Its output fell from 10,500 kw. to 8500 kw. The company shut down its two 1000-kw. steam plants, which burned 70 tons daily, and purchased 2000 kw. from hydroelectric plants of the S. D. Warren Paper Company, Westbrook.

The Cambridge (Mass.) Electric Light Company lost one-half of its load, but some exemptions increased consumption on Monday. The local Fuel Administrator has ordered a moonlight street-lighting schedule.

The Manchester (N. H.) Traction, Light & Power Company lost about one-quarter of its power load, saving about 60 tons of coal per day.

The New Bedford (Mass.) Gas & Edison Light Company was affected materially. Its output on Thursday, Jan. 17, was 207,971 kw.-hr. On the Friday following it was 63,273 kw.-hr. The peak loads were respectively 15,500 kw. and 4700 kw. The coal consumption of this company was 183 tons Thursday and 82 tons Friday.

The Worcester (Mass.) Electric Light Company load fell from 11,000 kw. to 2700 kw., and the consumption of coal decreased from 225 tons to 62 tons. Through exemptions 1000 kw. was added on Monday.

The day load of the Fall River (Mass.) Electric Light Company dropped from 6500 kw. to 700 kw. The output on Thursday was 112,300 kw.-hr. and on Friday 36,000 kw.-hr. The consumption of coal was 108 tons on Thursday and 50½ tons on Friday. The relative consumption per kilowatt-hour was 2.16 lb. on Thursday and 3.14 lb. on Friday. The night peaks were respectively 7700 kw. and 2650 kw.

The load of the United Electric Light Company, Springfield, Mass., fell from 12,000 kw. to 3000 kw. on account of heavy decreases in consumption by merchants and manufacturers. The company saved 100 tons of coal daily, and it has begun to discharge employees as a measure of economy.

The load of the Fitchburg (Mass.) Gas & Electric Light Company fell from 2500 kw. to 400 kw. Exemptions soon increased the latter to 600 kw. The New England Power Company supplied the entire Fitchburg load during curtailment.

The Lowell (Mass.) Electric Light Corporation and the Edison Electric Illuminating Company of Brockton, Mass., operated by Stone & Webster, lost in power loads, but munition plants lessened the reduction at Lowell. The Brockton load fell from 8500 kw. to 1200 kw. despite the army shoe contracts of local factories.

Maine utilities suffered less than other localities because of the available water power.

The Lynn (Mass.) factory of the General Electric Company was exempted; also the Terry Steam Turbine Company factory at Hartford, Conn.

The Hartford Electric Light Company load fell from 23,000 kw. to 10,000 kw. Two-thirds of the factories at Bristol, Conn., are operated by hydroelectric power from Falls Village, and it is expected that they will be operated on future Mondays. A similar hope is expressed in Willimantic, Conn.

The Salem (Mass.) Electric Lighting Company day load fell from 7500 kw. to 2000 kw. The Malden (Mass.) Electric Company plant was shut down for five days, and necessary requirements were supplied from Salem through a tie line. The total saving at Salem was about 35 tons per day; normal consumption is 85 tons; daily output dropped 50 per cent at Salem.

Effect of Order in Chicago and Central West

The central-station industry of the Middle West is in hearty accord with the Fuel Administrator's recent order. The necessity of such drastic action is appreciated fully.

The situation in the larger centers, Cleveland and Chicago in particular, had reached a stage where it was only a question of whether the industrial shutdown would be made in an organized manner or whether it would be made in individual cases as the absolute necessity became apparent. Since the latter method was open to so much chance for discriminatory practice the adoption of the former plan is hailed with satisfaction.

There is little sympathy, however, with the policy which permitted the country's fuel supply to get into its present state. Criticism of the Fuel Administration from that angle is heard regularly from central-station sources; but now that the situation exists the present method of solution is viewed as the best way out of a bad fix.

The cause of the situation, as seen by central-station executives of the Middle West, is almost wholly one of transportation. Had the public been made to realize ten years ago that a starvation system of revenue for the railroads would react against the national good ultimately, such a calamity as this fuel crisis could not have occurred. Furthermore, all during last summer the public was led to believe that coal would be cheaper in the fall so that many coal consumers put off purchases. It is believed that the government should have urged people to buy coal early in the summer and have shown that prices would probably go up.

The effect of the order on central-station outputs and revenues will not be so great as might be expected at first. Data which have been worked out show that heatless Monday is a better central-station day than any typical Sunday. The belief is expressed that the total effect of the Garfield order will be less than a 3 per cent reduction in output for January for a large Middle Western company.

WAR SERVICE WORK OF THE UTILITIES COMMITTEE

National Committee on Gas and Electric Service on Duty in Co-ordinating Work of Utilities with Government War Needs

The National Committee on Gas and Electric Service, of which John W. Lieb is chairman, has issued a report of its current activities. This committee is rendering a service in co-ordinating the work of electric and gas utilities with war needs. In part the report says:

This committee has placed at the disposal of the Fuel Administration two representatives who have their offices continuously in that bureau to handle the complaints of the public utilities and endeavor to obtain such relief as may be possible.

The Fuel Administration has recently added to its staff a public utility representative in the conservation department of that bureau, whose particular duties shall be to work out as much as possible the conservation of fuel in the operation of public utilities.

Another member has been added to the National Committee on Gas and Electric Service in the person of H. G. Bradlee of Stone & Webster. Mr. Bradlee, as is well known, brings to the committee a vast knowledge and experience along public utility lines.

TEXT OF THE REGULATION TO PROVIDE FUEL SUPPLY

A More Adequate Supply for Railroads, Domestic Consumers, Public Utilities and Other Uses Necessary to National Security

Following is the full text of the regulation of ~~Dr. H. A. Garfield~~, United States Fuel Administrator, issued Jan. 17:

The United States Fuel Administrator, acting under the authority of an executive order of the President of the United States dated Aug. 23, 1917, appointing said administrator, in furtherance of the purposes of said order and of the purposes of the act of Congress therein referred to, approved Aug. 10, 1917, and finding it essential effectively to carry out the provisions of this act to make provision for a more adequate supply of fuel for railroads, domestic consumers, public utilities and for other uses necessary to the national security in certain parts of the United States, hereby makes and prescribes the following regulation:

Section I.—Until further order of the United States Fuel Administrator, all persons selling fuel in whatever capacity shall, in filling their contracts or orders now on hand, give preference to necessary current requirements of railroads, domestic consumers, hospitals, charitable institutions, army and navy cantonments, public utilities, by-product coke plants supplying gas for household use, telephone and telegraph plants, shipping for bunker purposes, the United States for strictly governmental purposes (not including factories or plants working on contracts for the United States), manufacturers of perishable food or of food for necessary immediate consumption, and municipal, county, or state governments for necessary public uses. Any tonnage remaining after the foregoing preferred shipments have been made may be applied in filling any other contracts or orders.

Section II.—On the following days, namely, Jan. 18, 19, 20, 21 and 22, 1918, the state fuel administrators and their accredited representatives in the various communities in the territory in which this regulation applies are hereby empowered and directed to divert such fuel as arrives in such communities in carload lots to meet the current requirements, and to provide an adequate and normal supply for such consumers of fuel as are specified in Section I hereof.

Section III.—On the following days, namely, Jan. 18, 19, 20, 21 and 22, 1918, and, also, on each and every Monday beginning Jan. 28, 1918, and continuing up to and including March 25, 1918, no manufacturer or manufacturing plant shall burn fuel or use power derived from fuel for any purpose, with the following exceptions:

(a) Plants which necessarily must be continuously operated seven days each week to avoid serious injury to the plant itself or its contents may use only such quantity of fuel as is necessary to prevent such injury to the plant or its contents.

(b) Manufacturers or plants manufacturing perishable foods or foods for necessary immediate consumption.

(c) Manufacturers of food not perishable and not necessary for immediate consumption may burn fuel to the extent authorized by the Fuel Administrator of the State in which such plant is located or by his duly authorized representative upon application by the United States Food Administrator.

(d) Plants necessary to the printing and publication of daily papers may burn fuel or use power derived therefrom as usual, except that on every Monday from Jan. 21 to March 25, 1918, inclusive, they may burn fuel or use power derived therefrom only to such extent as is necessary to print and publish such editions as such plants customarily print and publish on legal holidays other than the Sabbath; or, if such plants do not customarily print or publish any editions on such legal holidays, they may burn fuel or use such power to such extent as is necessary to issue one edition on the said Mondays.

(e) Printing establishments may burn fuel on Jan. 18, 19, 20, 21 and 22, 1918, to such extent as is necessary to issue current numbers of magazines and other publications periodically issued.

Section IV.—On each Monday beginning Jan. 21, 1918, and continuing up to and including Monday, March 25, 1918, no fuel shall be burned (except to such extent as is essential to prevent injury to property from freezing) for the purpose of supplying heat for:

(a) Any business or professional offices, except offices used by the United States, state, county or municipal governments, transportation companies, public utility companies, telephone or telegraph companies, banks, trust companies, physicians or dentists.

(b) Wholesale or retail stores, or any other stores, business houses or business buildings whatever, except that for the purpose of selling food only stores may maintain necessary heat on any of the specified days until 12 o'clock noon, and except that for the purpose of selling drugs and medical supplies only stores may maintain necessary heat throughout the day and evening.

(c) Theaters, moving-picture houses, bowling alleys, billiard rooms, private or public dance halls, or any other place of public amusement.

Section V.—On each Monday beginning Jan. 28, 1918, and continuing up to and including March 25, 1918, no fuel shall be burned for the purpose of heating rooms in which intoxicating liquor is sold or served on those days.

Nothing in this regulation shall be construed to forbid the heating of restaurants, hotels or other places in which meals are served but in which no intoxicating liquor is sold or served on the said Mondays.

Section VI.—No fuel shall be burned on any of the Mondays specified in the foregoing section for the purpose of supplying power for the movement of surface, elevated, subway or suburban cars or trains in excess of the amount used on the Sunday previous thereto.

Section VII.—Nothing in this regulation shall be construed to apply to or affect the operation of any mine or plant producing fuel, nor shall this regulation be construed to forbid the heating of such rooms or offices or such portions of buildings as are used in connection with the production, transportation or distribution of fuel.

Section VIII.—State fuel administrators and their representatives specifically authorized so to do are hereby empowered to grant such relief as may be essential to prevent injury to health or to prevent destruction of or injury to property by fire or freezing.

Section IX.—This regulation is effective throughout the United States east of the Mississippi River, including the whole of the States of Louisiana and Minnesota.

Section X.—Any person, firm, association or corporation which violates or refuses to conform to the above regulation may be liable to the penalty prescribed in the aforesaid act of Congress.

REASONS FOR THE ORDER

In explanation of his order, Dr. Garfield issued the statement given in part below:

The most urgent thing to be done is to send to the American forces abroad and to the Allies the food and war supplies which they vitally need. War munitions, food, manufactured articles of every description, lie at our Atlantic ports in tens of thousands of tons, while literally hundreds of ships, waiting loaded with war goods for our men and the Allies, cannot take the seas because their bunkers are empty of coal. The coal to send them on their way is waiting behind the congested freight that has jammed all terminals.

It is worse than useless to bend our energies to more manufacturing when what we have already manufactured lies at tidewater, congesting terminal facilities, jamming the railroad yards and sidetracks for long distances back into the country. No power on earth can move this freight into the war zone where it is needed until we supply the ships with fuel.

More than a shock was needed to make a way through that congestion at the terminals and on the docks so that the aid so vitally needed by the Allies could get through.

The incidental effect of this transportation situation on coal production has been disastrous. There is and always has been plenty of fuel, but it cannot be moved to those places where it is so badly needed while railroad lines and terminals are choked.

LARGE CALIFORNIA SYSTEMS UNITE FOR PERIOD OF WAR

As War Measure to Economize Fuel Four Great Companies Agree to Joint Operation—Total Capacity 377,600 Kw.

For the period of the war and in the interest of fuel economy the Pacific Gas & Electric Company, the Great Western Power Company, the Sierra & San Francisco Power Company and the Universal Electric & Gas Company have agreed to operate their systems under one management. P. M. Downing, chief engineer Pacific Gas & Electric Company, electrical department, will have charge of the jointly operated systems.

Under this plan several standby plants can be shut down without endangering continuity of service as provided by the joined systems. By operating only those centrally located standby plants whose efficiency is highest a great saving of fuel oil will be effected and loads will be distributed so that water storage on each system can be used to maximum advantage.

This action was taken after joint conferences with State Fuel Administrator Schwabacher and the California Railroad Commission, and it is a development which followed the detailed consideration of the interconnection of transmission systems, a report of which appears following this article. The power companies have announced that the unified service will be continued as long after the war as such action may be deemed in the interest of the public. The combined systems serve about 40,000 square miles, believed to be the largest area yet administered by a single management. The total generating capacity of the combined system at present is about 377,600 kw., of which 240,000 kw. is hydroelectric power and the remainder steam.

A careful observer of California conditions makes the following comment to the ELECTRICAL WORLD on the new arrangement:

> The consolidation of central California power systems for joint operation as a war measure is one of the long strides forward which are made from time to time in the West. It is not often, however, that so important a move is made literally overnight or is launched without precedent largely on faith that all concerned will do their part fairly. Much credit is due the several companies for the spirit shown in joining competitors without hesitation or limitation. The redistribution of load, it is understood, is to be made by one man, Mr. Downing, without let or hindrance, the determining factor always being the efficiency of the several systems considered as one unit and the minimum consumption of fuel.
>
> Even if the attitude of the competing companies had been such that this move might have been made before, it would not have been feasible because the public would have resented and opposed it with all the vigor of the sentiment against trusts, but now in the emergency of war and facing fuel famine the economies of monopoly in public utility management have not only become apparent to the man in the street but are being urged on the companies themselves as patriotic duties.
>
> One of the most important features of the move and one which there has not yet been time to work out in detail is the apportionment of income under the combined plan of operation. However, with all concerned in a co-operative rather than a competitive attitude, it will be simply a matter of agreeing upon that plan which seems fairest to all. With the rainfall in California thus far the least in sixty-nine years, a plan which contemplates utilizing water storage more efficiently cannot impair the interests of stockholders. No man could be found who has better qualifications than Mr. Downing as "power dictator" for the California systems. Not only does his experience eminently qualify him to handle the complex problems of this work but he has the complete confidence of the several companies involved. The success of the plan under his administration may well establish a precedent that will be far-reaching in effect.

ADVANTAGES OF TYING IN THE CALIFORNIA SYSTEMS

Costs of Interconnection and Attendant Fuel Saving Discussed by Representatives of the Companies and Railroad Commission

A hearing was held by the California Railroad Commission on Jan. 14 to discuss with representatives of the various power companies ways and means for combining transmission lines and otherwise co-operating to reduce fuel consumption. The commission engineering department filed a preliminary careful study of interconnection possibilities. In this it was pointed out that the immediate requirements for 1918 of the four chief power companies supplying the San Francisco Bay region call for an increase of more than 200,000,000 kw.-hr. of energy and more than 50,000 kw. peak capacity, as compared with 1917.

There is a marked diversity between the several generating systems, the report stated, especially in low-water seasons, which can be employed to advantage to offset part of the increased demand. But in any event the concentration of load and rapid growth in the San Francisco Bay region necessitate an increase in transmission facilities. The present lines for bringing power into San Francisco are entirely inadequate, resulting in the unnecessary use of steam-produced energy and preventing what would otherwise be a saving in fuel oil. In fact, the future growth in power requirements of the companies operating in the bay region, the report stated, will necessitate expenditure of over $5,000,000 annually by utilities to provide generating plants and transmission lines alone to meet the demand.

A large amount of unused hydroelectric power in northern California is practically ready to be marketed. Additional transmission lines must be built and existing lines reinforced to make this supply available at consumption points. If present methods of separate operation are allowed to continue, increased demand can be supplied only by steam-produced energy. This will require more than 1,000,000 bbl. of oil per annum more than is now consumed. If interconnections are made and power available in the north be added to the transmission network, saving at the rate of over $200,000 per year in fuel oil, the report stated, can be begun at once.

The commission engineers stated that committees from each of the two natural divisions in the State have been appointed to co-operate in working out details of interconnection as follows:

Northern division: John A. Britton, Pacific Gas & Electric Company; Mortimer Fleischhacker and H. F. Jackson, Great Western Power Company; W. F. Detert, Northern California Power Company; J. D. McKee, California-Oregon Power Company; Samuel Kahn, Western States Gas & Electric Company; A. G. Wishon, San Joaquin Light & Power Company.

Southern division: R. H. Ballard, Southern California Edison Company; William Baurhyte, Los Angeles Gas & Electric Company; A. B. West, Southern Sierras Power Company; H. H. Jones, San Diego Consolidated Gas & Electric

Company; A. G. Wishon, San Joaquin Light & Power Company.

Reporting for the northern committee, H. F. Jackson said that careful consideration had been given to the possibilities of interconnecting the Northern California and California-Oregon transmission systems with the Pacific Gas & Electric, thereby bringing these companies into the northern division network. This interconnection would involve construction of two tie lines and an additional circuit on the present power line from Nicolaus to Cordelia. This construction would cost about $1,700,000, he thought.

In considering additional power available for the northern division, it was pointed out that extension of the Drum development could add 12,500 kw. to the network. The Great Western Power Company reported 50,000 kw. additional power available for development and the Sierra Company has about 9000 kw. which could be developed economically. Committees were appointed to report on these connecting lines and the increased power possibilities.

Mortimer Fleishhacker foresaw considerable difficulty in raising the money necessary to carry out interconnection on a satisfactory scale. Most companies are hard pressed to secure money necessary even for routine operation, and with all costs increasing and rates stationary it would be practically impossible to induce capital to put money into power company extensions at present. Earning capacity of Pacific Coast companies has fallen off and stocks and other securities have decreased in value accordingly. He failed recently to raise funds in Eastern centers for extending the Great Western system because the profit was not sufficient to interest new investors. However, if rates were increased present stockholders could probably be induced to improve their investment by some further advancement of capital.

As a war measure Mr. Fleishhacker urged that something should be done to enable companies to finance hydroelectric development. Two or three shipyards are being constructed and other extensive industrial load is coming in the bay region. Meanwhile, power companies have stopped generating-plant extensions because of labor and material prices. With the rainfall thus far recorded this year the lowest in sixty-nine years, he predicted inevitable power shortage next season because of lack of stored water.

P. M. Downing, chief engineer Pacific Gas & Electric Company, classified the northern division interconnection problems under two heads—first, effectively tying together three large companies for off-peak load, and, second, the best means of getting the Northern California and the California-Oregon systems economically tied in to the central network. An inexpensive solution of the first of these would be to tie the Great Western and the Sierra systems together indirectly, using Pacific Gas & Electric lines as the connecting link. He did not think sufficient energy would be transferred over a direct connection to effect an oil saving that would justify the cost of making the direct tie-in. As to getting power from the northern systems into the central group, he thought it would be necessary to construct several hundred miles of transmission line, bringing this power, approximately 12,500 kw., down to the Cordelia substation. This amount of power, on the basis of 200 kw.-hr. per barrel of oil, would be the equivalent of 420,000 bbl. of oil, or a saving of $500,000 per year. Cost of the transmission lines necessary to effect this tie-in would be about $1,500,000.

R. H. Ballard, general manager Southern California Edison Company, submitted a written report for the committee which has been studying conditions in the South. He pointed out that the southern section is already well interconnected and that the next move should be development of more water power to reduce present oil consumption in auxiliary and standby plants. About $600,000 per year, he thought, is the saving now secured as the direct result of interconnecting systems, and he expressed firm conviction that saving could be made in any part of the country where interconnection was at all feasible.

E. F. Scattergood, chief electrical engineer Los Angeles power bureau, presented a plan for decreasing oil consumption in that city, as part of the movement for conservation.

In closing the hearing, Commissioner Devlin said that he foresaw the possibility of great saving of fuel as a result of the action that could probably be taken and set Jan. 31 as the date for hearing sub-committee reports.

WATER-POWER BILL STEPS TAKEN IN WASHINGTON

Lower House of Congress Appoints Committee Which Will Report on Administration Bill—Senate May Stand by Shields Bill

The House of Representatives on Jan. 11 took the first step toward passing the new administration water-power bill expeditiously by adopting a resolution providing for appointment of a special committee to which all bills and resolutions introduced during the Sixty-fifth Congress, except those touching foreign affairs, which deal with water-power matters shall be referred.

The resolution adopted by the House discharges from further consideration the various bills on water power of the committee on interstate and foreign commerce and the committee on public lands, which have been before the House for some years, and the old bills are to go to the new committee.

The resolution in excepting bills and resolutions touching foreign affairs leaves in the hands of the House foreign affairs committee proposed legislation in regard to Niagara Falls water power.

Senators are studying the administration water-power bill. The Washington correspondent of the ELECTRICAL WORLD reports ground for the belief that those who feel that legislation of some definite character should be enacted at the present session would do well if they sent their views on the new bill to Senators immediately.

The fate of the new bill, so far as the Senate is concerned, is now hanging in the balance in that body. The long delays and wide differences of opinion which have prevented water-power development may continue, and there may be no legislation at the present session unless Senators can be made to see that agreement is necessary. It is still understood in Washington that President Wilson intends to have conferences with Senators as he had with House members, and he may persuade Senators to look upon the bill favorably.

But Senator Shields of Tennessee, who led the forces

which passed the Shields bill in the Senate, has pointed out to the Washington correspondent of the ELECTRICAL WORLD that the Shields bill as passed by the Senate was a compromise measure, and he said further that twenty Senators not present when the vote was taken would have voted for the Shields bill, he was informed, if they had been present. The Senate will not lightly rescind the stand it took when it passed the Shields bill as a compromise.

REORGANIZATION PLAN OF THE ORDNANCE DIVISION

Guy E. Tripp, Chairman of the Westinghouse Company, Among Those Who Serve as Civilian Heads of Divisions

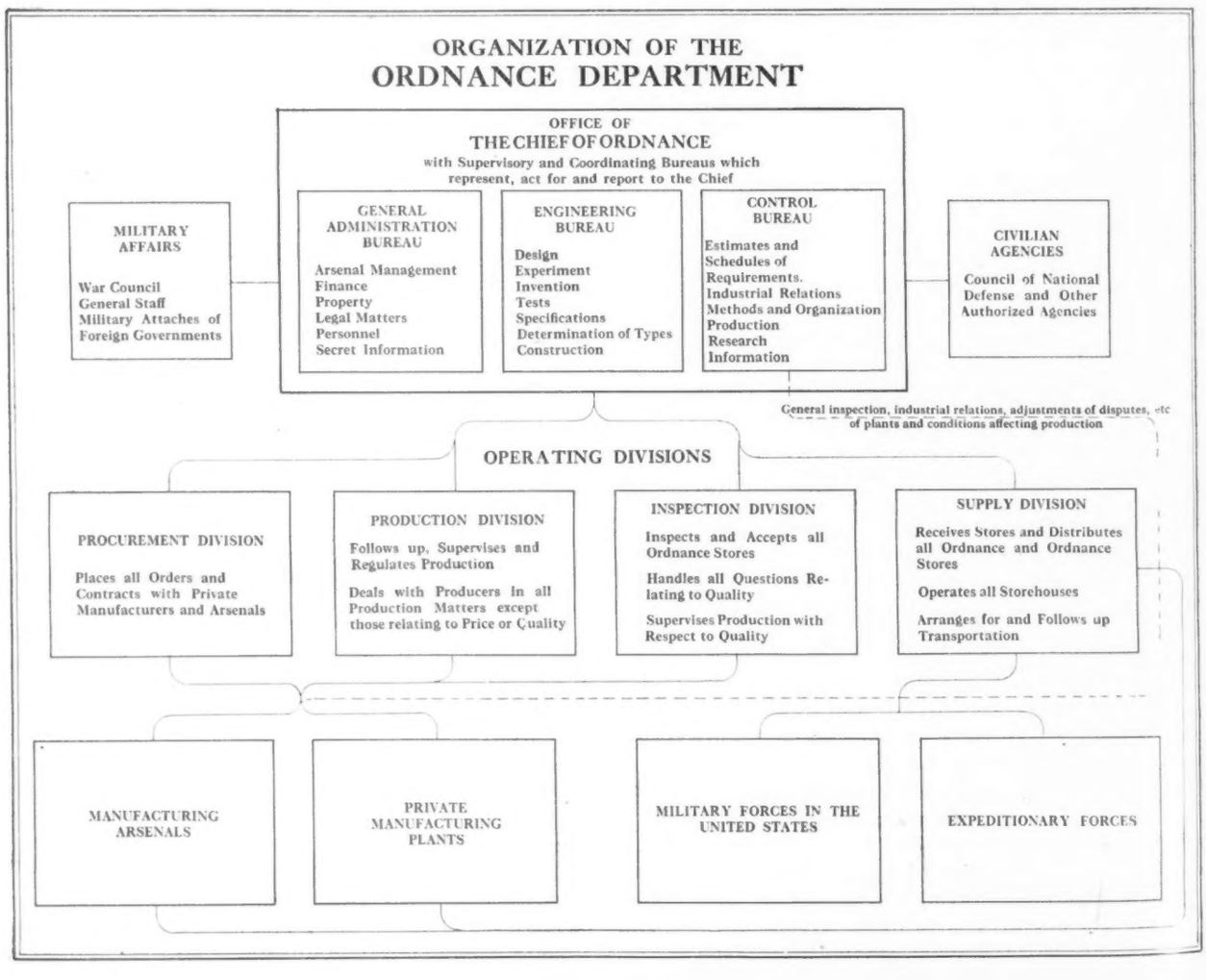
General Wheeler, acting chief of ordnance, War Department, has announced the appointment of a number of civilians as heads of new divisions in the ordnance branch of the department, in addition to Samuel McRoberts, formerly executive manager of the National City Bank of New York, in charge of procurement work.

Guy E. Tripp, formerly chairman of the board of the Westinghouse Electric & Manufacturing Company, who has been given leave of absence by the directors of that company for the period of the war; Charles N. Black, engineer, of New York, and Ralph Crews, lawyer, of Chicago, whose practice in business has been of a large character, will join General Wheeler's staff as civilian heads of divisions. Mr. McRoberts will be in charge of procurement work, but it is stated in Washington that the exact work to be done by the other civilians is not yet settled.

The ordnance division of the War Department has been reorganized by the creation under the chief of a general administration bureau, an engineering bureau and a control bureau. Under these are a procurement division, a production division, an inspection division and a supply division.

The general administration bureau will deal with arsenal management, finance, property, legal matters, personnel and secret information. The engineering bureau will deal with design, experiment, invention, tests, specifications, determination of types and construction. The control bureau will deal with estimates and schedules of requirements, industrial relations, methods and organization, production, research and information of a general character.

In the operating line the procurement division will deal with the placing of all orders and contracts with private manufacturers and arsenals; the production division with following up, supervision and regulation of production and with producers in all production matters except those relating to price or quality; the inspection division with inspection and acceptance of all ordnance stores, and it will also handle all questions relating to quality and will supervise production with respect to quality; the supply division will receive



stores and distribute all ordnance and ordnance stores, will operate all storehouses and arrange for and follow up transportation.

SUCCESSFUL MEETING HELD AT DAYTON, OHIO

Several Papers Are Presented at Gathering of the Industrial Power and Heating Section, with War in the Foreground

The first meeting of the industrial power and heating section of the new-business co-operations committee of the Ohio Electric Light Association was held in Dayton on Jan. 16 and was attended by about 150 from various parts of Ohio and neighboring States.

Frank B. Steele, power engineer Dayton Power & Light Company and chairman of the section, presided. He referred to the fact that this was the first meeting and that the next meeting of the section would be held in Cleveland in May.

Judge E. P. Matthews, vice-president Dayton Power & Light Company, made the address of welcome. In addition to welcoming the out-of-town men, he referred to the opportunity of the central stations at this time to secure all the power business in their communities. He also spoke of the wonderful development that had been made in the industrial business of Dayton because the Dayton Power & Light Company had been in a position to take care of this business.

Dwight D. Miller, Society for Electrical Development, New York, presented his paper on "Low-Temperature Industrial Heating."

In discussing this paper C. D. Carlson, Cleveland Electric Illuminating Company, referred to conditions in Cleveland and stated that there are approximately forty electric ovens operating in that city at present covering twelve different uses, as follows: Auto parts, stove parts, vacuum cleaners, wooden handles, tools and wrenches, multigraph parts, toys, shrapnel varnish baking, jobbing and armature coil baking, drying lime on wire and metal furniture.

Mr. Carlson stated that every electric oven that had been installed in Cleveland had stayed and that the cost of operating compared very favorably with that of gas. The ovens in Cleveland vary from a capacity of 15 kw. to 212 kw., and the largest installation totals 800 kw. The paper was also discussed by C. I. Crippen of the Mahoning & Shenango Railway & Light Company, Youngstown, Ohio, who stated that malleable iron is being annealed at present in Sharon, Pa.

Following luncheon, George C. Smith, chief of industrial surveys, Baltimore & Ohio Railroad, Baltimore, made an address on "Industrial Surveys for Intensified Service." Mr. Smith told what the railroad company is doing in making surveys of the various cities along its lines and how this information is used, not only in seeing that industries are located most advantageously for them, but also how the entire communities are benefited from the information that the Baltimore & Ohio company obtains through these surveys.

When the convention reconvened in the afternoon C. A. Winder, General Electric Company, Niagara Falls, N. Y., presented an interesting paper on "The Uses of Electricity for the Manufacture of Chemicals." In the discussion Mr. Winder pointed out the necessity for water-power development near the center of the markets of the United States. He stated that Far Western hydro developments will have little effect on commercial production of electrochemical products. Mr. Winder cautioned central stations against loading their lines with chemical industries which could not withstand competition after the war. The paper was also discussed by W. P. Whittington, Springfield Light, Heat & Power Company, and C. I. Crippen of the Mahoning & Shenango Railway & Light Company, Youngstown.

R. L. Yates, assistant manager Platt Iron Works Company, Dayton, presented his paper on "Water Pumping by Electricity." This paper was discussed by Dwight Miller, Society for Electrical Development, New York; F. H. Hooper, Northwestern Ohio Electric Light & Power Company, Van Wert; W. P. Whittington, Springfield Light, Heat & Power Company; Wirtt S. Scott, commercial heating engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, and C. I. Crippen, Mahoning & Shenango Railway & Light Company.

In the evening a banquet was held under the auspices of the Electric Club of Dayton in the Miami Hotel. Frank B. Steele, power engineer Dayton Power & Light Company, acted as chairman and introduced Judge Roland W. Baggott of the Court of Domestic Relations as toastmaster.

Capt. Paul M. Lincoln, consulting engineer Westinghouse Electric & Manufacturing Company, East Pittsburgh, in his address on "The Electrical Industry and the War," said that it was the business of every one connected with the industry to make the utmost effort toward winning the war.

Mayor J. M. Switzer had as his topic "The City and the Public Utilities" and pleaded for frankness on the part of both the city government and utility corporations, suggesting that the utilities frankly discuss the present difficulty with the public through newspaper advertisements. Mayor Switzer held that the Kaiser alone was responsible for the present coal shortage, and therefore the people should bear with the utilities in their effort to serve.

D. L. Gaskill, Greenville, the secretary of the Ohio association, talked along patriotic lines, but made a strong plea for public co-operation with utilities under the present stress and laid emphasis on the great difficulty of public utilities in securing fuel and meeting the extreme high cost of coal and all other commodities.

Charles F. Kettering, president Dayton Engineering Laboratories Company, in his opening remarks paid great tribute to the Dayton Power & Light Company and gave it the credit for solving all the power problems incident to the unusual industrial developments in Dayton.

Lee Warren James, president of the Greater Dayton Association, had as his subject "The Commercial Organizations and Public Utilities," and told how the Greater Dayton Association was endeavoring to cooperate not only with the city government, but also with the public utilities in serving the people of "dominant Dayton."

Edward R. Kelsey, governor of the district for the International Rotary Clubs and director of publicity Toledo Railways & Light Company, brought a message of war service for every electrical man. Mr. Kelsey has just been appointed chairman for Ohio for the "Smileage" campaign.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Western Society of Engineers.—Officers of the electrical section of the Western Society of Engineers were elected at a meeting Jan. 14 as follows: Chairman, E. N. Lake; vice-chairman, J. R. Cravath; members of executive committee, Earnest Lunn and Charles H. Norwood.

Lynn Section, A. I. E. E.—The annual banquet of the Lynn Section, American Institute of Electrical Engineers, will be held this year on Saturday evening, Feb. 2. A number of prominent speakers are being considered for the main feature of the program. Ex-president Charles A. Coffin and President E. Wilbur Rice are to be invited.

Utah Contractors and Dealers Meet.—Members of the Salt Lake district of the Utah Society of Electrical Contractors and Dealers met at the Commercial Club on Jan. 4. Officers for 1918 were elected and the business of last year was reviewed. The new officers are: President, George R. Randall; vice-president, G. W. Forsberg; secretary-treasurer, F. C. Wolters; executive board, E. M. Dobb, R. C. Carter and James Swyers.

San Francisco Electrical Development League.—The league meeting on Jan. 9 was Ladies' Day, and Mrs. Aurelia Reinhart, president of Mills College, talked on "What Women Can Do in the Present Crisis." Mrs. Emerick, a noted lecturer on Mesopotamia, told about recent conditions there. Mrs. Robert Burdette, leader of women's activities in food conservation, spoke on that subject. The chairwoman of the day was Mrs. H. F. Jackson, wife of the president of the Pacific Coast Section, N. E. L. A.

Program of Western Association of Electrical Inspectors.—The program for the "win-the-war" meeting of the Western Association of Electrical Inspectors at Memphis, Tenn., Jan. 29, 30 and 31, has been arranged as follows: Address of welcome, Frank L. Lucas; president's address, Emil Anderson, Milwaukee; "Conservation," James F. Joseph; "Underwriters' Laboratories and the Great War." A. R. Small; address on "Safe Electrical Requirements for Oil Refineries"; general discussion of "The Use of Electricity in Winning the War"; general discussion of "Rational Economies in Grounding," led by Carl K. Chapin, Memphis; address by William F. Dunbar, Atlanta, Ga.; report of the committee on outside wiring by F. W. Derby; report of the committee on show-window and display lighting by F. P. McGough; report of the committee on installation and operation of induction motors by K. W. Adkins; report of the committee on architects' specifications by F. H. Moore; report of committee on electric traction systems by F. R. Daniel; report of committee on demand factor by Guy W. See. There will also be an open discussion of inspectors' problems.

Meetings of the American Association of Engineers.—On Jan. 14 the Pittsburgh Chapter of the American Association of Engineers held a meeting at the Fort Pitt Hotel, P. B. Waldin, president of the Pittsburgh Branch, addressing the chapter on "Engineering as a Profession." The offices of the chapter are at 1312 Fulton Building. The Cleveland chapter, of which T. J. Brennan, 512 Columbia Building, is chairman, held a meeting on the evening of Jan. 15. The Philadelphia Chapter held a meeting on Jan. 18 at which the general secretary of the association spoke on the "Objects of the American Association of Engineers and the Receiving of Recognition for the Engineering Profession."

Cincinnati Electric Club and Jovian League Branch Merge.—The Cincinnati Jovian Electric Club was formally organized at a meeting of electric men of that city held Jan. 15 at the Hotel Sinton. The meeting was called for this purpose, following several steps taken by members of the Cincinnati Chapter of the Jovian League and the Cincinnati Electric Club looking toward the merger of the two organizations. The latter body was formed a year or so ago on account of the lack of interest which had become apparent in the senior organization, but both continued to exist, with a majority of local electric men holding memberships in both. The move for consolidation, to eliminate the dual membership with its attendant expense and waste of time and effort, began several months ago, and both organizations appointed committees with this object. W. W. Freeman, B. W. Down and Joseph C. Bowman were named for the Jovian League, and Thomas Creaghead, Mr. Wickham and O. B. Marsh for the Electric Club, with Mr. Downs as chairman of the joint committee and Mr. Marsh as secretary. The Jovian committee promptly reported favorably on the plan to consolidate, and the Electric Club took similar action on Jan. 7. The meeting of Jan. 15 was therefore a joint meeting of the membership of the two organizations to ratify the action of their executives and to elect officers for the new organization. The new constitution is virtually that of the Electric Club, so that a Cincinnati man interested in the organization may be a member without at the same time being a member of the National Jovian League. At the meeting the following officers were elected, following the unanimous ratification of the merger: President, F. D. Van Winkle; first vice-president, J. A. Brett; second vice-president, O. B. Marsh; secretary and treasurer, Joseph D. Bowman; directors, W. W. Freeman, W. A. Draper and William Hanley. Addresses were made by W. C. Culkins, Cincinnati, city street railway director, and Vice-president Walter A. Draper of the Cincinnati Traction Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Massillon Announces Its Record Day.—The Massillon (Ohio) Electric & Gas Company closed the year 1917 by making Dec. 31 its record day in output, having a net generation for that date of 104,490 kw.-hr., the output for the month of December being 2,786,000 kw.-hr. The output for the year ended Dec. 31, 1913, was but 1,898,374 kw.-hr. The output for December, 1917, was therefore one and a half times that of the entire year 1913.

Pacific Gas & Electric Passes Common Dividend.—In announcing a decision to pass the current dividend on Pacific Gas & Electric Company common stock, President F. G. Drum says in part: "In the present circumstances of decreased net earnings and the necessity of conserving the company's cash resources, your directors decided to omit any dividend on the common stock for the last quarter of 1917. During the past year our business has grown rapidly. Perhaps the best measure of this is the net addition of 26,699 customers in the eleven months to Nov. 30, 1917, as compared with a net addition of 16,147 in the first eleven months of the preceding year. The average new investment per customers has been steadily increasing since 1911, and is now greater than it ever has been owing to higher labor costs and the practical doubling of the cost of materials. War conditions, which, on the one hand, have stimulated our growth and increased the necessity for new capital expenditures, have, on the other hand, made it practically impossible for corporations generally to secure new money except at prohibitive rates. In the eleven months to Nov. 20, 1917, compared with the same period of the preceding year, gross operating revenues increased $1,096,617, expenses increased $1,661,813, and net operating revenues decreased $565,196. In the twenty-three months covered by the foregoing comparison 43,949 additional customers have been connected to the company's lines. During the same period $8,267.892 of additional cash has been invested, substantially all in productive properties, including new hydro-electric installations. That this large additional investment, the increased number of customers and the larger gross earnings in the conduct of the business have not added to the net income but have served merely to diminish the loss is due to the fact that, notwithstanding the extraordinary increase in the cost of our products, the selling prices of these products have, at best, remained stationary and are still established on conditions that existed prior to the war. We confidently expect relief in the near future."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

C. H. Sanderson has resigned as assistant chief engineer of the Havana Electric Railway, Light & Power Company to become manager of the auto and truck department of the Frank G. Robbins Company of New York and Havana.

L. E. Caldwell, who for the last five years has been manager of the Iowa City (Iowa) Light & Power Company, has resigned to become manager of the La Crosse district of the Wisconsin-Minnesota Light & Power Company. In this capacity he will have charge of the gas, electric and heating plants in La Crosse, Wis., and its suburbs. For the last two years Mr. Caldwell has been secretary and treasurer of the Iowa section of the N. E. L. A. Before going to Iowa City he was for eight years in the employ of H. M. Byllesby & Company of Chicago.

H. A. Hornor has recently resigned his position as electrical engineer of the New York Shipbuilding Corporation of Camden, N. J., effective Feb. 1. Mr. Hornor has been connected with this company for seventeen years, during which time he has greatly advanced the applications of electricity in the marine field. He is chairman of the marine committee of the American Institute of Electrical Engineers and has been active in various engineering societies. Mr. Hornor has been a frequent contributor to the journals of the electrical technical societies and is the author of the article on marine applications in the "Standard Handbook for Electrical Engineers."

M. C. Gilman, sales manager of the Toronto Electric Light Company, Ltd., has been appointed secretary of the Canadian Electrical Association to succeed Alan Sullivan, resigned. Mr. Gilman was graduated in 1907 from the electrical engineering course at Pratt Institute, Brooklyn, N. Y., and since that time has been employed in the central-station field. He has been assistant power engineer of the Edison Electric Illuminating Company of Brooklyn, assistant power engineer of the Public Service Electric Company, Newark, N. J.; power engineer of the Virginia Railway & Power Company, Richmond; power engineer of the Toronto Electric Light Company, assistant to the chief engineer of that company and for the last four years sales manager of the company.

John Hayes Smith, consulting engineer of Milwaukee, has closed his office to accept a position as assistant engineer to the Public Service Commission of Pennsylvania. Mr. Smith is a graduate of Cornell University. He associated himself with the Westinghouse Electric & Manufacturing Company shortly after graduation, remaining in their employ about six years. He was the first manager of the *Electric Journal*, from which he resigned to become editor of the *Electrical Age*, in which work he remained for four years, when he went to Milwaukee. For two years he was with the Milwaukee Electric Railway & Light Company, resigning as commercial engineer to take up consulting work. For the last four years he has been actively engaged in consulting engineering work in Milwaukee, as well as in rate and valuation work in other states.

Harry F. Butler, formerly associated with the Consolidated Telephone Company, has been elected manager for the Lehighton Electric Light Company, Lehighton, Pa.

Charles Bulkley Hubbel has succeeded Major Henry W. Hodge, now in military service, as a member of the Public Service Commission for the First District of New York.

Charles N. Black of Ford, Bacon & Davis, New York, has gone to Washington to become assistant manager of the procurement division of the ordnance department. Mr. Black is a past-president of the American Electric Railway Association, and up to about a year and a half ago was vice-president and general manager of the United Railroads, San Francisco, Cal. He was elected president of the American Electric Railway Association in 1913.

C. N. BLACK

Guy E. Tripp, who, as noted in these columns, last week, has been appointed head of the division of production of the ordnance department of the United States Army, has received a commission as colonel.

H. B. Sewall, who has long been connected with Stone & Webster properties in the Central West and in the South and Southwest, has been appointed manager of the Whatcom County division of the Puget Sound Traction, Light & Power Company, with offices at Bellingham, Wash., succeeding Leslie R. Coffin, who has been ordered to report for duty at Philadelphia.

F. M. Nourse has joined the advertising department of the Cutler-Hammer Manufacturing Company of Milwaukee in the capacity of technical writer. Mr. Nourse is a graduate of the electrical engineering course of the University of Illinois, class of 1912, since which time he has been engaged in various branches of engineering work. After graduation, several years were spent with the Northern Illinois Utilities Company, after which he became a motor sales engineer for Roth Brothers, Chicago. In 1915 Mr. Nourse took charge of the Portage (Wis.) division of the Wisconsin Power, Light & Heat Company, and later became associated with the Electrical Engineers' Equipment Company of Chicago.

B. J. Denman, for many years vice-president and general manager of the Tri-City Railway & Light Company, Davenport, Iowa, has been elected president of the company. Before going to Davenport four and a half years ago, Mr. Denman was chief engineer of the power plants of the Detroit Edison Company. Mr. Denman entered the electrical field in 1892 as oiler, carshop helper and conductor with the old Toledo Railway Company. From 1895 to 1899 he was electrician for the Toledo & Maumee Valley Traction Company and the next year joined the instructional staff of Toledo University. With W. G. Clark he engaged in consulting engineering work in 1900 and 1901, and for three years following he acted as electrical engineer for the Toledo, Bowling Green & Southern Traction Company, in charge of power houses, shop and rolling stock and overhead lines. In 1905 he became connected with the Detroit Edison Company, and there in addition to being chief engineer he did a large amount of commercial engineering work besides doing practically all of the appraisal work for the Detroit companies and being retained as special engineer and supervisor of power-house construction. Mr. Denman is a graduate of the University of Michigan, where he has served as assistant professor of mechanical engineering and non-resident electrical engineering lecturer on power plants, substations and railway engineering.

Obituary

Frank N. Voshell, engineer at the power plant of the Public Service Electric Company, Camden, N. J., died Jan. 11, at his home, at the age of forty-two years.

Robb Mackie, assistant to manager of the supply department, Westinghouse Electric & Manufacturing Company, died at his residence in Pittsburgh on Jan. 5.

Lieut. Gordon Dale Cooke, who prior to entering the service of the country was a member of the field force of the McGraw-Hill Company, publisher of the ELECTRICAL WORLD, died of pneumonia at the base hospital, Fort Bliss, Tex., on Jan. 10. Lieutenant Cooke was a graduate of the University of Michigan.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ANALYSIS OF SITUATION IN ELECTRIC SIGN TRADE

Opportunity Is Afforded to Collect Excellent Sales Data Which Can Be Used to Good Advantage When the Fuel Shortage Is Passed

In observing the effect of the Fuel Administrator's order with regard to electric signs, some unusual sidelights have developed. While this order did not exactly kill the electric sign business, it slowed it up to a considerable degree. Some signs, however, are still being sold, especially in water-power territory. The smaller sign-manufacturing concerns are finding it expedient to go into some other line of business which for the duration of the war will prove more profitable. Large concerns which feel that they can weather the storm are afforded an opportunity to collect sales data of a character positively unobtainable heretofore. Merchants with signs are now willing to give actual testimonials that days following "lightless" nights show a falling off in trade. These facts are not being overlooked by wide-awake central-station commercial men or by the more progressive sign manufacturers.

MANUFACTURERS URGE JOBBERS TO PURCHASE LIBERALLY

A Policy Not Altogether Acceptable—Staple Stocks Ample—Temporary Squeeze on Heating Appliances

Freight congestion, the responsible cause of the more backward delivery of electrical goods of every description, and also the reported variance in local haulage charges, have been upsetting to jobbing circles. Reports are circulating in the trade that jobbers are being insistently, even persistently, urged to cover their requirements on an unusually liberal scale. This attitude is explained on the ground of the uncertainty of obtaining needed raw material in sufficient quantity, the inadequacy of the labor supply and the continuing delays of shipping, now aggravated by the order for fuel conservation.

A jobber who is inclined to follow a conservative course in buying, but at the same time is almost always in a strong position in caring for his dealer trade, was of the opinion that manufacturers were pursuing a wrong course. He said his and other houses in the field were being induced to place big orders in fear of threatened complications likely to arise from present business conditions. The engagements entered into were to be promptly filled and shipped. The non-arrival of the goods, in the face of what several jobbers believe is a falling market, is causing anxiety. As against this, distributers operating on a large scale declare that, knowing that most factories are behind on orders, the securing of adequate stocks of staple electrical lines is becoming more difficult. Such a condition, it is averred, will therefore probably become even more acute.

Pursuing this line of argument, it is believed by representative houses that the safe course to follow is to allow suppliers all the time possible in filling orders. Prompt attention should be given to requirements for spring stocks, especially construction and line material for immediate use. As a fact, dealers are said to be buying with caution and not anticipating their needs adequately. Doubtless sales would be in larger volume if factories could supply more goods and better deliveries could be assured. Nevertheless, there seems to be a satisfactory movement of general lines.

TAKING THE LOST MOTION OUT OF BUSINESS METHODS

Jobbers Endeavoring to Educate Trade Along Lines That Will Reduce Cost Incurred in Handling Small Orders and Return Shipments

Some jobbers in the Middle West are using a direct-by-mail campaign to educate contractors and other customers to the advantages that accrue from ordering in larger quantities and to the necessity of making a service charge on return shipments. As indicating the character of these campaigns the following letter, recently sent to the trade by the Downing Electrical Company of Des Moines, is interesting:

"The big electrical jobbers have been making a very careful study of their orders and find that 55 per cent of them are for less than $10. The average amount of all orders is $28.59. The average cost of handling all orders less than $10 is $3.93 per order. The cost of handling return shipments is 30 per cent of their value.

"Our good friends can do much to help us hold down our expense in these days, when we are paying twice as much for all kinds of packing materials, cartage, labor, etc., by sending us as large an order as possible and eliminating the return of merchandise whenever possible.

"We realize that you are bound to order merchandise at times when so doing is an error on your part, and we give you this notice so you may know that when we charge 10 per cent service charge on return shipment we are absorbing the big end of the expense. We also want to impress upon you the fact that we are short of salesmen these days and shall appreciate your sending your orders by mail."

EFFECT OF THE WAR ON DEVICES FOR SAFETY

Opinion of Authority Is that the Trend of Events Indicates that Greater Precautions than Ever Will Be Taken to Protect Workers

As the result of the knowledge of the vast sacrifices of human life in the war the minds of business men in this country have undoubtedly become accustomed to and inured against shocks from reports of sudden death or physical disablement. Such a transition in mental processes might reasonably be expected to harden the industrial executive against movements for greater safety in the conditions surrounding plant employees. The facts are, however, that this is not the case. The exact opposite appears to be true. Undoubtedly the reason for this condition is the belief, now practically established, that safety movements are not a matter of sentiment but are a matter of good business judgmen. It has been found a paying investment to spend money to prevent accidents.

That this is the case is evidenced by the increased business among concerns making safety appliances and concerns marketing consulting safety services. Likewise the increased interest in safety movements since the war brought about the present labor shortage is evident through the same channels. The safety device manufacturers generally are very busy. Some have more business than they can handle. When a group of these manufacturers recently met to discuss an annual convention and exposition for 1918 the interest in this event was intense. The National Safety Council of Chicago showed in its recent annual report that its membership had increased 68 per cent in the last year, which means that 1447 industrial and public utility concerns

subscribed for consulting safety service in that fiscal year and that the workmen reached by this body then had reached a total of 4,500,000. Shipbuilding plants and others engaged in government business are among latest groups to study and apply accident prevention methods.

In spite of this increased effort, accidents in the last year have slightly increased. This has been caused by the immense labor turnover, necessitating the employment of many "green" men. Leading authorities in safety work say, however, that the number of accidents would have increased at a more marked rate under the existing conditions had it not been for the continued effort to prevent them. This growth in accidents is another factor which has contributed to make the business of the safety-device manufacturer continue in a healthy state.

METHOD OF PAYING FOR GOVERNMENT ORDERS

Under Certain Conditions Manufacturers Will Be Reimbursed for Raw Materials Prior to Manufacture

It has not been particularly clear in the minds of some members of the electrical trade just how the government proposes to pay for the goods it buys. In a proposal recently issued for large quantities of electrical goods the General Engineer Depot made the following statement regarding payment:

"Payment will ordinarily be made for each item as soon as it has been inspected, accepted and delivered, properly packed, f.o.b. cars (or boat) at place stated in proposal. Under certain conditions, in the case of standard products the sufficiency of which in their completed form is already known from previous use, partial payments to the extent of a previously agreed-upon percentage of the total cost of each component part of the article to be furnished will be made when such component parts are known to be on hand in the factory ready for assembly. Such component parts will then become the property of the United States, and are to be safeguarded by the manufacturer in a way acceptable to the purchasing officer, in order to prevent loss to the United States through destruction or theft of same."

METAL MARKET SITUATION

The Producers' Desired Advance in Copper Not Realized—Other Metals Unchanged

With no advance in the price of copper such as the producers were aiming for, conditions have not changed from what were previously reported. The conference with the Board of War Industries in Washington adjourned a week ago without allowing the suggested advance to 25 cents, but continuing the present selling figure to June 1, stating its reasons therefor. The price will consequently remain at 23.50 cents for first hands and 24.67½ cents for industrial consumers. Wire is figured on a 30-cent base, and no further reduction is anticipated. No change of any consequence has taken place in conenction with the other metals.

NEW YORK METAL MARKET PRICES

	Jan. 14	Jan. 21
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00*	27.00*
Lead, trust price	6.75	6.75
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter	19.00	19.00
Spelter, spot	7.82½ to 7.92½	7.82½ to 7.92½
Tin, Straits	$5.00*	$5.00*
Aluminum, 98 to 99 per cent.	35.00 to 37.00	34.00 to 36.00
OLD METALS		
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 14.00	13.75 to 14.50
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.25 to 6.37½	6.25 to 6.37½
Zinc, old scrap	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK IN TRADE

NATURALLY the unusually severe cold weather and unprecedented snowstorms prevailing east of the Rocky Mountains to the Atlantic seaboard have been and are yet the influential factor in the week's business. Shipments were further interfered with and deliveries are slower than before. However, business is reported as not only in a satisfactory condition, but much better than a year ago, with a record breaker predicted for 1918 in electrical goods. Prices were announced on a higher level, averaging 10 per cent, on several staple lines, with a scarcity of merchandise in evidence. Refillable fuses are in demand, as well as flashlamps, motors and electric ranges for cantonments and hotels. Lamps, interior wiring and other articles used in small construction are also selling well.

Collections up to the arrival of the storms were reported from fair to excellent. A setback may follow, but this is only a surmise on the part of correspondents. There is no change in the extension of credits being made since the first of the year.

NEW YORK

Predictions are freely made that 1918 will develop a higher sales record on electrical goods, devices and appliances than has ever before been reached. January's record so far exceeds that of 1917 by a comfortable margin. Jobbers are reported as having liquid stock in ample supply, with a few exceptions, and it is expected to move easily. Buying is said to be on a careful basis, however. Business is especially strong in the coal regions, despite the snowstorms and inclement weather. Deliveries have not improved. Collections are found satisfactory, accounts being settled quite promptly. Caution continues to be exercised with credits.

FUSES.—An active market is anticipated for fuses in this field, particularly of the removable type, according to representative jobbing houses. The manufacturers are getting busy and their sales forces are initiating what promises to be a fruitful compaign. No price changes have been announced.

FLASHLAMPS.—An advance of 10 per cent was recently made by one of the leading flashlamp manufacturers. Business is excellent in this specialty and the demand is brisk.

SOCKET DEVICES.—Preparatory to a strenuous sales campaign during the entire year unusually large stocks of every household socket device are being ordered. This applies more directly to sewing-machine motors and washing machines, with other articles following in close order. It is believed that 1918 will be the greatest sales year in these goods that has ever been known. Studied attention will be given what is known as the "residential buyer" as a potential factor of the future. Current sales are somewhat checked by the curtailment and even refusal of energy by central stations, in obedience to the retrenchment order of the Fuel Administrator.

GLASS INSULATORS.—Within two weeks another advance of 10 per cent on glass insulators was made by one of the oldest manufacturers. A still further price increase is not improbable if present conditions continue. None of the factories is running for lack of fuel, and orders are filled from stock, which is reported as gradually reaching a pretty low stage. Shipments are made promptly from the glass plants when railroads will accept them or they are not prohibited by embargoes; deliveries are not guaranteed.

LINE MATERIAL.—Prices on line material, which have been abnormally high, have been reduced by an Eastern producer 10 per cent, effective Jan. 15. This manufacturer of hardware had accumulated a surplus stock, and reports

say he was obliged to lower his figures to reach a market. This reduction does not apply generally, and quotations are still high in other directions. Locust pins are still scarcer, with prices $2.50 a thousand higher than previously quoted, also effective as of Jan. 15; but this, too, is an exceptional case. Different mills name varying prices, according to location and stock on hand. Rock-elm pins are being mentioned as coming into use as a substitute for locust, on account of the scarcity and cost of the latter.

COLLECTIONS AND CREDITS.—Prompt returns on collections are the average tenor of reports. Jobbers and distributers have opened the year with their books in better shape than is customary. No relaxation on credits is observed.

CONDUIT PIPE.—The market is reported as bare of conduit pipe in all sizes. A great quantitiy is in transit, but even the usually well informed on such matters dare not say when the goods may be found. Prices just now do not figure as much as delivery.

PORCELAIN INSULATORS.—High-voltage insulators were marked up 10 to 12 per cent within a few weeks, but the low-voltage type remains untouched. Stocks are none too plentiful and deliveries are slow. High-voltage goods are back four months, caused by slowness of production and delivery, but low-voltage insulators are in a slightly better position.

CHICAGO

During the past two weeks Chicago and the entire Middle West have undergone the most severe weather conditions in their history. Deep snows and severe cold have paralyzed transportation and slowed down industrial activity in every direction. The Garfield order, becoming effective this week, has made business additionally quiet.

Jobbers report orders coming in as usual, but deliveries are very much delayed. In compliance with the coal order business was practically suspended last Monday. Offices as well as factories closed. The general spirit has been to comply with the order as given, although personal opinion is almost unanimously critical of the ruling. Wire prices have not changed. In general there has been very little activity or change in conditions from last week.

A bulletin issued by the American Washing Machine Manufacturers' Association states that manufacturers have agreed to eliminate 171 distinct styles and models as a conservation measure but demonstrates that the washing machine is a labor-saving device and essential to winning the the war. The total factory value of the machines produced during 1917 was $10,000,000, an increase of 42.8 per cent over 1916. Practically all of the plants are situated west of Pittsburgh, and most of them are in the Mississippi Valley.

The entire incoming and outgoing tonnage of the 106 manufacturers was less than 10,000 tons per month. The total coal used during 1917 was only 20,000 tons.

MOTORS.—The motor price book issued Jan. 1 by the Emerson Electric Manufacturing Company, St. Louis, Mo., shows somewhat lower prices on repulsion-start-type single-phase motors, ½-hp. and larger; direct-current motors, ½-hp. and larger, and Davidson exhaust fans. There was no reduction, however, in the prices of other sizes and kinds of apparatus.

BOSTON

Electrical trade continues very brisk, despite the shutdown caused by the Garfield order. Jobbers closed Monday and salesmen on the road suspended work. Some Saturday afternoon work will be necessary partially to offset the curtailment. Jobbers cannot handle the present volume of business in eight hours daily, and as 75 per cent trade in some cases is government work no hope of exemption from the Monday order or short day enforced by the Massachusetts Fuel Administration is entertained. There is a tremendous reduction in central-station loads caused by the fuel order, many companies losing half to two-thirds the station output. The fuel saving is large, but not in proportion to the load reduction. Prices are holding firm; deliveries are temporarily worse because of railroad congestion. There is little change in collections, and the curtailment will probably affect these adversely for a short time. Retail dealers have a rather quiet trade, many going over stocks and planning the year's business along labor-saving lines.

Large orders for switch and wiring material from the government have been given to switch factories, one maker reporting 1000 locking-type switches ordered. The government housing program is also leading to substantial wiring material orders. Porcelain is very scarce and high-priced. Copper is in fairly plentiful supply to electrical manufacturers. Labor is easier in the Connecticut Valley, 4500 men being discharged from munitions work in Bridgeport a few days ago.

The outlook is excellent for electric heating apparatus, especially for table appliances saving labor and conserving food through a better control of the cooking process. A reduced scale of living in smaller quarters predisposes many to purchase grills and small hot-plates. Factory stocks are low. Radiators are in heavy demand and deliveries are impeded by freight embargoes. It is hinted that prices may advance in high-class electric heating equipment for table service, though this is not certain.

Small turbines quote seven months' delivery on the non-condensing sets. There is some delay in getting generators for turbo units. Prices advanced about 10 per cent very recently. Skilled labor is scarce, but no serious effort is yet made to use women in the shops. Raw material is delayed by railroad difficulties, manufacturers state. Probably nine-tenths of the representative small turbine work is for the government.

Wire manufacturers are stocking up on the smaller sizes, and to a moderate extent prices are firm. There is a heavy government demand for power cable. A shutdown hampered production, as the factories on government orders are not generally exempted. The lamp situation is improving, and the entire stock of one manufacturer, wiped out by a fire Christmas week, is now replaced, involving about 500,000 lamps. Barring transportation delays, conditions should improve steadily. Manufacturers are making more lamps than ever before.

ATLANTA

A general rainstorm visited the South Friday and Saturday of last week and covered a wide area, which helped the water-power companies materially, but the precipitation was not sufficient in some sections to insure altogether against future curtailment from these sources. The timely rains, however, will permit the water-power companies to shut down auxiliary steam generating equipment during the present crisis and supply all power requirements from hydroelectric sources until the water gives out or, at least, until the five-day fuel-conservation period has expired. The sections using fuel for power purposes have calmly acquiesced in the disturbing industrial order, and the sections served from hydroelectric transmission lines are thankful for being allowed to continue operations. Although the industrial fabric has received a severe shaking, an undercurrent of optimism prevails in this section regarding future business activity.

Reports from authentic sources indicate that Americus, Ga., has been selected for an aviation camp, similar in type to the one being constructed at Montgomery, Ala., which will call for the expenditure of several millions. The government has definitely decided to locate a repair shop at Atlanta, Ga. This plant will cost in the neighborhood of $2,000,000.

It is reported that General Crozier has arranged for the immediate construction of a powder plant, to cost $60,000,000, at Hadley's Bend on the Cumberland River, near Nashville, Tenn. This plant will cover 4600 acres and employ 15,000 men.

STEAM-FLOW METERS.—The demand for this type of meter in the last year has been more or less sporadic, but the recent publication by the Fuel Administration of literature on fuel conservation has stimulated activity in this line and a number of equipments are being purchased for boiler rooms and slashers in the textile field.

SEATTLE

The week from Jan. 14 to 21 shows general business maintaining a steady and substantial volume, with both jobbers and retailers reporting gratifying sales far in excess of those experienced last January. Seattle jobbers report sales to shipyards, mills and other industrial plants very satisfactory, although there is no particular increase over last week. Seattle retailers, however, report a noticeable increase in sales, due primarily to increases along residence repair and building lines, over last week and a distinct increase in sales over January of last year. Portland jobbers report the placing of an extra large order for power apparatus, including motors, generators, turbines, panels, etc., for a million-dollar steel shipyard in Vancouver, Wash. This yard recently received a contract from the government for ten steel ships of 9500 tons capacity at a price of approximately $17,000,000. The new plant will also manufacture boilers and machinery. Another four-million-dollar contract for steel ships was received last week by the Portland yard from the United States Shipping Board.

Portland jobbers as a whole report exceptionally heavy business with industrial plants so far this year. Retailers also report increasing sales of fixtures, wiring devices, lamps and other things used in small construction. Orders for cannery supplies for Alaska are being placed in large amounts more than a month earlier than was the case in previous years.

Buying will continue until April, when navigation to the north will be open. Cannery men are making space reservations with steamship companies and are not taking chances of a shortage of vessels in Alaska due to the war. Jobbers report that, while buying is heavy, the volume this year will not be so large as last year. While large orders are being placed for motors, generators and electrical accessories for new canneries, a large portion of the volume will be for repairs, maintenance and enlargements. Alaska electrical dealers are not buying nearly so heavily as last year, reporting business decreasing materially, owing primarily to the closing down of many mines on account of low-grade ores, increasing cost of labor and labor shortages, and secondarily to migration of Alaskans to Northwestern shipbuilding cities. Fisheries and canneries will continue activities as usual and government railroad work will proceed, otherwise Alaska is expected to be comparatively quiet.

Reported activities of small telephone companies in rural communities, looking toward some new construction and repairs, lead jobbers to believe small orders for wire, pole-line equipment, etc., will be placed shortly. Sales to telephone companies for the year past have been light, mostly for maintenance and repairs.

The contract for 500,000 incandescent lamps for Seattle's municipal lighting department will be let Feb. 1. The Board of Works of Seattle will open bids March 1 for the proposed five-million-dollar hydroelectric plant.

Steadily increasing demand for real estate has been a feature of the Seattle market since the beginning of the new year. Building permits for the first three weeks in January show an increase of 80 per cent over those for last year. Electrical permits in both Seattle and Tacoma since Jan. 1 show an enormous increase over same period last year.

During the first nineteen days of this month Seattle shipyards established a record that eclipses the industry's entire record for the year 1916. A vanguard of 20,000 skilled mechanics, who are to be sent to Northwest shipyards to carry on the gigantic shipbuilding program, arrived Monday. Owing to the enormous prices offered for timber products, many new logging firms are springing into existence. Machinery houses note increasing demand for machinery.

The freight situation remains very unsettled. Deliveries are bad, with no evident signs of immediate betterment. The government has not yet begun to insist upon maximum car loading. Intra-terminal switching is slowly being worked out, but the results expected have not materialized.

FUSES.—There is an increasing demand for refillable fuses, a large number of which are being used for repairs and maintenance work. Prices are steady and stocks are adequate.

HOUSEHOLD APPLIANCES.—Movement is quite slow as was to be expected following heavy holiday sales. However, irons, washers and sewing machines are selling better than could be expected.

WIRE.—A slight drop in price was noted early in the month. Stock shortage is no worse than heretofore reported. Deliveries are very unsatisfactory. The volume of sales shows a slight increase during past two weeks.

PORCELAIN.—The demand is increasing and shipments are hard to obtain and prices are on the increase.

SAN FRANCISCO

War-time activities or matters incidental thereto have steadily increased in their percentage of total business done, and changes that came with the new year have given this percentage large advances. Committees are effectively at work in relieving freight congestion and encouraging fuel economy. In the San Francisco "power dictator" is centered the control of more than 400,000 hp. Farm and factory are being made to serve war-time needs. New lumber mills are being laid out, primarily to supply material for shipbuilding and airplane plants. The mining of certain metals has been speeded up, while others are being neglected. In the bay region the construction of new yards for both steel and wooden vessels is so common as no longer to attract special attention. Collections are reported as very satisfactory, and practically no change in the extensions of credits has been made since the new year.

ELECTRIC RANGES.—Special attention is being given to hotel-type ranges and bake ovens. Installations of large size—that is, as many as six hotel-type ranges each—are being considered at some of the cantonments, and inquiries are being received from many organizations which provide food for large numbers of employees, guests or men in government service. Ranges of types for family use are not usually active at this season. Jobbers are holding off on 1918 range orders, apparently to see what effect the heating-appliance merger will have on the manufacture of ranges and because there have been rumors of a standardized range, but representatives of manufacturers in the merger affirm that three distinct types will be manufactured as heretofore. Family range sales in 1917 were 40 to 50 per cent more than 1916 sales, and an equal rate of increase over last year is predicted by manufacturers for this season. Power companies are less confident, but manufacturers point out that the business will be forced upon them because of the publicity.

METERS.—There is a steady demand for meters of switchboard type, and customers are becoming accustomed to taking substitutes in place of the exact type desired.

INTERPHONES.—One large company which has for some time solicited no business and refused orders for interphones has resumed the manufacture of this line and is now again actively in the market.

MOTORS.—The lowest rainfall on record in California has caused a rush for irrigation installations, and one company reports ten orders in rapid succession for motors of more than 100 hp., all for irrigation use. The demand for small sizes also continues steady, but no material change in delivery conditions is apparent. Several new irrigation districts will be completed and put in service this year, which will call for electrical equipment.

BUILDING CONSTRUCTION.—There is continued activity in the building line in the smaller towns, particularly in agricultural districts. The city of Sacramento has building construction totaling $6,250,000 projected for this year. A considerable part of this is for Capitol extensions, but in part it reflects the generally prosperous condition of the agricultural areas in the Sacramento and San Joaquin valleys.

MOVING-PICTURE MACHINES.—A considerable trade in portable moving-picture projectors has been built up this winter, and the demand is increasing. The popular type are motor-driven machines costing slightly more than $100. These are used for instruction purposes in training camps and schools and for demonstrations. The accessories, including lenses, are rheostats, carbons for lamps, lamp cord and fuses.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages or specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the source of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B.&S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

No. 14 Solid

Less than coil.....+10% to $61.00
Coil to 1000 ft.....+10% to $59.17

No. 12 Solid

Less than coil.....List to $71.00
Coil to 1000 ft.....—10% to $68.87

Twin-Conductor

No. 14 Solid

Less than coil.....List to $105.00
Coil to 1000 ft.....$70.00 to 10%

No. 12 Solid

Less than coil.....List to $135.00
Coil to 1000 ft.....10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

No. 14 Solid

Less than coil.....+10% to +20%
Coil to 1000 ft.....— 5% to —10%

No. 12 Solid

Less than coil.....+10% to +20%
Coil to 1000 ft.....— 5% to —10%

Twin-Conductor

No. 14 Solid

Less than coil.....+10% to +20%
Coil to 1000 ft.....—10% to $80

No. 12 Solid

Less than coil.....+10% to +20%
Coil to 1000 ft.....—5% to —10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....List to 10%
1/5 to std. pkg.....15% to 20%
Std. pkg.....28% to 34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....+20% to 12%
1/5 to std. pkg.....20% to list
Std. pkg.....28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft
⅜-in. s. stp.	Net to $75.00	—12% to $69.75
⅜-in. d. stp.	+5% to 78.75	— 9% to 72.00
½-in. s. stp.	List to 100.00	—12% to 93.00
½-in. d. stp.	+5% to 100.00	— 9% to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
¾-in. single strip	$75.00	$63.75
¾-in. double strip	78.75	71.25
½-in. single strip	100.00	85.00
½-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.— $25.00-$55.00	$20.50-$24.75	$20.00-$22.00
¼-in.— $28.00-$60.00	$22.50-27.00	$20.00-$24.00

NET PER 1000 FT.—CHICAGO

Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in., $36.67-$55.00	$25.00-$37.50	$22.50-$24.75
¼-in., $40.00-$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS. RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37
2½	.58½
3	.76½

	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 9%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	1.3% to 3.7%	4.3% to 6.7%
2500-5000 lb.	3.3% to 5.7%	6.3% to 8.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.....$5.00 to $6.00
Discount.....25% to 30%

CHICAGO

List.....$5.00 to $6.00
Discount.....25% to 30%

FUSES, INCLOSED

	Std. Pkg.	List
250-Volt		
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.....28%
1/5 to std. pkg.....38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3¼ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4¾ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$24.90 to $31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $35.60
Coil to 1000 ft.	21.50 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F A., 7, C S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to $20.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N. C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net
1/5 to std. pkg.	15% to 20%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	$25.00 to $45.00
1/5 std. pkg.	23.00 to 42.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—10% to 11%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	...30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net to +10%
$2.00 to $10.00 list	10% to 20%	5% to 10%
$10.00 to $50.00 list	20% to 30%	15% to 20%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15% to 20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25% to 35%	20% to 25%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $7.50
Discount	25% to 30%

CHICAGO

List price	$4.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net.
No. 18, less than full spools.	$0.44¼ to $0.65
No. 18, full spools.	0.43¼ to 0.55

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0.60 to $0.65
No. 18, full spools.	0.50 to 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11	$15.00-$18.00	$13.00-$14.00	$11.00-$11.50
12	23.25- 25.41	21.30- 21.78	15.97- 19.35
10	32.40- 35.21	29.70- 30.18	22.13- 27.00
8	45.70- 49.12	41.90- 42.12	30.88- 38.00
6	72.40- 77.84	66.35- 66.72	48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$18.00	$13.00-13.50	$11.50-12.00
12	25.33-25.69	22.02-25.33	18.35-20.40
10	30.48-33.04	27.94-30.03	22.86-28.33
8	42.54-48.97	38.99-41.98	31.90-39.42
6	66.46-67.38	56.15-62.05	50.53-56.39

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25 ...
50 to 100 lb.	34.25 to 38.25

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$35.50 to $40.35
25 to 50 lb.	34.35 to 39.35
50 to 100 lb.	33.50 to 38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Induction Motors

A line of two-phase and three-phase induction motors is now being offered the trade by the Phoenix Electric Company, Mansfield, Ohio, which has been standardized in construction. The stator or stationary part of these motors has a solid cast-iron frame into which are built the thin steel punchings which make up the magnetic circuit of the stator. The stator slots are partly closed, thus obtaining greater starting torque, it is pointed out, than with the open-slot type, and thereby reducing the inrush of starting current. The starting coils are carefully wound and taped and thoroughly impregnated with insulating varnish, making them waterproof.

Special attention has been given to the rotor to make it as durable as possible. The laminations are assembled directly on the shaft between malleable-iron heads, and heavy copper rings are securely riveted to the rotor bars and soldered, making a construction that is practically indestructible. With motors of 7½ hp. and larger a starter is provided which is of standard design of resistance type, without no-voltage release.

Louvers for Ventilating Fans

Louvers that are especially designed to prevent back draft and provide weather protection to fan openings when the fan is not running are made by the Batterman Truitt Company of Chicago. They consist of a number of semicircular vanes connected together in series. These vanes are pivoted slantingly with respect to a vertical plane and are inclined to drop

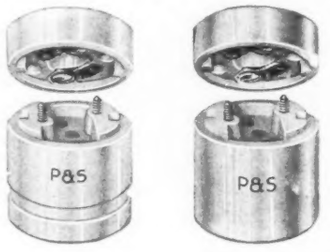
PREVENTS BACK DRAFT AND WEATHER PROTECTION

into a closing position without exerting an excessive resistance against their opening movement caused by air directed against them from the opposite side. The vanes when open or in partly open position occupy a dihedral angle with respect to the plane of opening and thereby, it is pointed out, afford a better passage of air from the fan that will parallel vanes operating transversely with respect to their opening.

These louvers operate with practically no restriction on the fan. They are so designed that, the area of the center bridge being calculated and allowed for in the total outer frame dimensions, no restriction is caused by the center bridge. These louvers, it is said, are not affected by moisture, heat or by ordinary vapors.

Two-Piece Porcelain Sockets for Reflectors

P. & S. 1233, a two-piece porcelain socket without shade-holder groove, and its companion piece, P. & S. 1234, with shade-holder groove, have been placed on the market by Pass & Seymour, Inc., of Solvay, N. Y., for heavy-duty sockets for medium or normal base type "C" lamp fixtures. These receptacles have ample wiring room or clearance for a



SOCKETS WITH AND WITHOUT SHADE-HOLDER GROOVE

single or double pair of wires in the terminal hood, which may be supported by substantial machine screws spaced 1 3/16 in. (3 cm.). on centers.

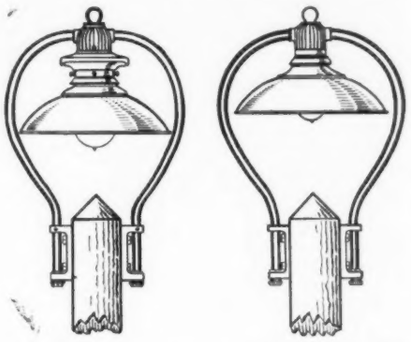
These receptacles are entirely front-connected, and the socket body is easily positioned by the aid of heavy porcelain tenons. All live parts, where necessary, are sealed in with a special compound which will successfully resist the extreme temperature to which the devices may be subjected in use.

Electric Log

The Majestic Electric Development Company, 1705 Allegheny Avenue, Philadelphia, is making an electric log for use in home fireplaces. Three elements of 6.15 watts each are mounted in front of a polished copper reflector. A regulating switch gives combinations of one, two or three units. The complete log weighs 35 lb. (15.8 kg.) and measures 19 in. by 12 in. by 10 in (48.3 cm. by 30.4 by 25.4 cm.)

Lyre-Top Fixtures

Lyre-top fixtures designed for use in railroad yards and similar places have been designed by the Wheeler Reflector Company, 16 Pearl Street, Boston, Mass. The fixture on the right



DESIGNED FOR USE IN RAILROAD YARDS

has a canopy with ports cast in the side into which the arms are screwed for forming the frame of the bracket. This canopy has a copper screw ring rolled inside which engages the threaded collar on the reflector, making a rigid support. The lyre top shown on the left is used with a high-tension series porcelain receptacle head and the same reflector shown on the right.

Inclosed Switches

Safety steel-inclosed switches that will operate in either a horizontal or perpendicular position, or may be reversed end for end, are being marketed by the Leonard-Bundy Electric Company of Cleveland, Ohio. The door of the cabinet cannot be opened without tripping the switch, which makes it impossible to fuse a live switch. The switch cannot be partly closed and left there, giving insufficient contact and heating of receptacle springs, because this switch is so arranged that if it is not fully closed it will fly open again.

A quick-break action is provided so that no arcing occurs at the contacts. The lever and toggle principle is embodied in the handle, and an easy pull will close the switch, while a slight blow is all that is necessary to open it, the switch in fact opening itself after being once started.

The switch and cabinet are built very substantially and are designed to stand up under very severe usage. The cabinets are made of No. 12 gage steel and are reinforced with angle iron throughout, while the switch is not only rugged and durable but will stand 50 per cent to 100 per cent overload without heating, it is said.

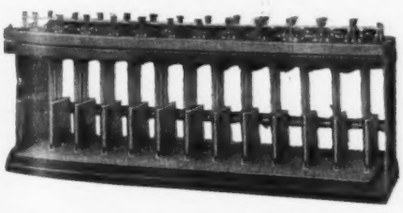
Luminous Indicator for Pull-Chain Sockets

A small luminous bulb which contains radium and glows in the dark is now being made by the Eastern Luminous Indicator Company, Inc., Waltham, Mass., for attachment to pull-chain sockets. This company is using the same radium compound in these small bulbs as has heretofore been used on dials and hands of watches, gages, clocks, compasses, etc., which it manufactures.

Charging Apparatus for Miner's Lamps

For the multitude of miner's electric lamps used in the mines a standard easily extensible charging rack has been developed by the Cutler-Hammer Manufacturing Company of Milwaukee. Each charging rack is designed to hold ten batteries, and as each rack is a unit an equipment may be laid out for a large number of lamps, or a small equipment can be purchased at the start and subsequently extended when additional lamps are purchased.

The racks are arranged to hook on brackets clamped on vertical 1¼-in. (3.2-cm.) iron pipe supports. Two of these brackets are furnished with each rack, and they are so designed that in adding to an equipment it is not necessary to disturb the brackets which are already in place. The racks are built with a substantial steel frame which carries slate slabs on which the batteries are placed for charging. The batteries are placed in the racks edgewise like books in a bookcase, which makes the apparatus very compact. Partitions are provided which prevent the battery cases from making contact with one another, and their design is such that a battery cannot be placed in the rack with the polarity reversed. On the top of the frame is mounted a slate slab carrying the contact parts. An inverted mushroom-shaped contact piece projects below this slab and is pressed in contact with the battery terminals by a substantial coiled spring. This is the only contact which is below the slab, all other current-carrying parts being mounted on the top, where they



UNIT CHARGING RACK CAPABLE OF ACCOMMODATING TEN BATTERIES

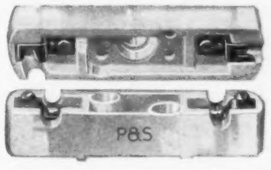
are out of the way of any discharge from the battery vents.

The circuit through the rack is laid out so that the batteries are charged in series, but provision is made by means of interpolating resistances so that one or any number of batteries can be removed from the rack without appreciably affecting the charging current through the remaining batteries. It is thus possible to remove or add batteries to a rack during the charge at will without the necessity for adjusting the rheostat. The contacts are all interchangeable, and it is a simple matter to remove the mushroom contacts for inspection or cleaning should this be found necessary.

Equally spaced contact plates are installed on the front of the frame and connected to the contacts for the battery terminals, making it possible to read the voltage across any battery in the rack while it is on charge without interfering with the charging circuit. A rheostat panel is used with each set of charging racks. The number of charging racks that can be used with one rheostat is governed by the voltage of the charging circuit end.

Pivoted-Cap Cleat Rosette

A cleat rosette of special rugged construction, designed to carry the wires fully ½ in. (1.27 cm.) from the surface wired over, has been brought out by Pass & Seymour, Inc., Solvay, N. Y. The terminals are arranged to separate the wires by a space of 2½ in. (6.35 cm.), and the binding screws which secure the cap to the base are so arranged that the cap may be pivoted on one end while the other end of the cap, when the binding screws are released, swings in



AMPLE WIRING ROOM IN BASE

or out of position and is thereby made easy to wire on a step-ladder or at the bench. Ample wiring room will be found in the base, and provision is made in the cap for a practical knot in the drop-cord to relieve the strain on the terminals. This rosette has been designated P. & S. 565.

Insulating Tubing

A line of insulating tubing is now being made by the Fibro Products Company, New Bedford, Mass., which is fibrous in structure and not so dense as vulcanized fiber. The maker points out that its structure is between that of ordinary paper tubing and a vulcanized fiber tube. It is claimed that it is extremely strong and possesses the advantages of being waterproof, of high dielectric strength and retaining its size and shape. The material lends itself to the processes of manufacturing tubing and makes it possible to produce a tubing with little variation in size. The company mentioned is now equipped to produce fibro tubes in any practical diameter, wall thickness and length.

Foot Warmer for Outdoor Service

To minimize the discomfort of long standing outdoors in severe weather, an electrically heated foot warmer has just been placed upon the market by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa. While designed primarily for look-

GIVES UNIFORM DISTRIBUTION OF HEAT

outs stationed in the bow and crow's nest of vessels, the device is applicable to the use of watchmen, sentries, doormen, traffic policemen and others whose work requires them to be out of doors continuously with little chance for exercise. It has been found that if the rest of the body is adequately clothed, a foot warmer will insure comfort at any temperature.

The device consists of a casting 14 in. by 20 in. by 25 in. (35.6 cm. by 50.8 cm. by 63.5 cm.), with diamond-tread top. This is of cast iron or of a non-magnetic metal when desired, as in ship service. Against the under service of this the heater element is clamped. The heater is a slotted ribbon clamped between two plates of built-up mica so arranged as to give uniform distribution of heat. A sheet-steel plate fastened by screws and sealed with high-melting gum renders the entire unit waterproof. The resistance is divided into two parts, which may be connected to draw 200, 100 or 50 watts at 125 volts. A three-conductor cable 7 ft. (2.1 m.) long is provided. By using the lower heats in mild weather there is no danger of causing chilblains.

Attachment Plug

A solid attachment plug, called the "Jiffy Junior," has just been put on the market by the Best Electric Company of Pittsburgh, Pa. The "Jiffy Junior" is made in one piece (with separate tip) of asbestos composition. The terminals are molded into the plug, and the brass screw shell is die-stamped permanently into place, giving a most substantial construction. By loosening one screw, the tip is removed and the plug is open for wiring. The wires are then cut to even lengths. No knots are necessary, as the right-angle strain reliefs securely hold the wires. This plug has the advantage of being quick and easy to wire. It is wired in the open, and one screw holds the plug together securely. Being made of asbestos composition, the plug, it is claimed, is indestructible and safe to use with any device.

Trade Notes

W. G. ARTHUR REID has been appointed general manager of the Bryan-Marsh branch of the National Lamp Works of the General Electric Company, centering at Detroit, Mich. This will be a separate division.

THE FIRST NATIONAL BANK of Boston, Mass., assisted by its branch in Buenos Aires, Argentina, is in a position to furnish exporters and importers with dependable and credit information and reliable statements of market conditions in the Argentine.

THE VULCAN STEEL PRODUCTS COMPANY of New York City is publishing a spirited illustrated monthly house organ entitled *Vulcan*. It is a journal of co-operation and help for the Vulcan company's interests, particularly in its rapidly developing export trade.

THE MOLONEY ELECTRIC COMPANY, LTD., of Toronto, Can., announces that it has opened a branch office and warehouse at Halifax, N. S., for the Maritime Provinces. E. A. Seath, who has been transferred from the Montreal office, will have charge of that territory.

JOHN D. STOUT has been appointed Chicago representative for the Terry Steam Turbine Company, Hartford, Conn. Mr. Stout was at one time assistant engineer of the Terry company and was recently transferred from the New York office, where he was assistant manager.

BURTON FRENCH, who has been associated with the Insull organizations in Chicago for the last eighteen years, has opened an office at 492 Continental and Commercial National Bank Building, as a consulting engineer, to engage in the preparation of appraisals, examinations, investigations and reports upon public utility properties for financing and operation.

THE IRVING NATIONAL BANK of New York City has issued for general distribution a pamphlet entitled, "Practical Questions and Answers on the Trade Acceptance Method." Besides the clearly presented information contributing to the campaign of education in the more general use of this species of commercial paper, it contains the improved trade acceptance form approved by the American Trade Acceptance Council. This body embraces committees of the Chamber of Commerce of the United States, American Bankers' Association and National Association of Credit Men.

THE ROBBINS & MYERS COMPANY of Springfield, Ohio, has appointed Edgar A. Wilhelmi, manager of its export department, with offices at 30 Church Street, New York City, in connection with the company's domestic quarters at the same address. Heretofore the concern's export business was looked after by Mr. Wilhelmi as president of Edgar A. Wilhelmi, Inc., which handled the foreign trade of several other manufacturers. The new appointee has made seven trips around the world, traveling in Europe, the South and Central American countries and the West Indies; consequently he is familiar with the details in connection with handling foreign business.

THE AMERICAN CHAMBER OF COMMERCE of Paris, France, desires to bring to the attention of American manufacturers who are sending copies of their catalogs to France the advisability of printing on such catalogs the date of their issuance. While catalogs sent to chambers of commerce and consulates are stamped with the date of their receipt and therefore an approximation of when they were issued is possible, if a business house or other recipient does not so stamp an incoming catalog there is a great chance of confusion of dates, with consequent misunderstandings between the foreign buyer and the American seller as to price, patterns, etc. The chamber has recently established a catalog file, and now possesses catalogs of more than 500 American firms. Owing to the ever increasing demand for American products and devices, members of the chamber as well as all American manufacturers interested in export trade are invited to send their catalogs to the chamber. These catalogs, after being properly indexed, will be open to all inquirers.

A NEW WESTINGHOUSE DEALER MAGAZINE.—To stimulate dealer interest and co-operation, the Westinghouse Electric & Manufacturing Company has just begun the issuance of a monthly publication. This paper is to be known as *Contact* and is the same size as the *Saturday Evening Post*, to permit effective display of its contents and full-scale reproduction of advertisements in national mediums. The new magazine will replace the Westinghouse company's monthly *Merchandising Calendar* and also the special publications distributed on merchandising campaigns which are issued from time to time through the year. The intention is to make *Contact* a clearing house of ideas for Westinghouse distributers. Whether these ideas cover window display, stock accounting, stock arrangement, canvassing or any merchandising problem, they will be welcome in its columns. New sales ideas, successful campaigns, plans for more business, for bigger net profits, for better service from employees, are being solicited by Westinghouse representatives throughout their trade. The first issue contains articles on getting rid of after-Christmas stock, bigger profits by better planning of advertising according to a definite schedule, sales letters that "bring home the bacon," and the value of the proper spending of our money in winning the war. *Contact* is sent gratis to dealers in Westinghouse supplies and appliances.

THE LYONS FAIR will be held at Lyons, France, March 1 to 15, 1918. It will be the third annual event, the first two fairs having been held in 1916 and 1917 in the full tide of war. The press has recorded an almost unhoped-for success. The amount of business transacted was 57,000,000 francs in 1916 and 180,000,000 francs in 1917. The last figures do not include the business done by means of catalogs in the United States bureau. The amount of this business alone totaled $42,000,000. Numerous and lasting business relations have been created between parties who were entirely unknown to each other before the advent of the fair. In 1916 no American concern was represented at the fair, and last year, in spite of extensive publicity, only thirty-three firms were represented. It is hoped, however, that this year the United States will be well represented. American business men should realize that the Lyons Fair will give them contact not only with French buyers but with buyers from Spain, England, Holland, Italy and all the other exhibiting countries. This fair is not an exhibition but a commercial proposition. No goods can be sold at retail, orders being booked in wholesale quantities from samples exhibited. Particulars concerning rules and regulations may be obtained from George B. Van Cleve, 1790 Broadway, New York City, who is chairman of the American committee of the Lyons Fair.

Trade Publications

MILLIVOLTER.—The Pyroelectric Instrument Company of Trenton, N. J., has issued circular No. 9, descriptive of its Northrup millivolter.

PORTABLE TOOLS.—The Stow Manufacturing Company of Binghamton, N. Y., is distributing a bulletin entitled "Portable Tools of Proven Value."

STOKERS.—Leaflet 3986, descriptive of underfeed stokers, has been issued by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa.

LIGHT CONTROLLER.—The Barrett automatic light controller for Ford cars is described in a leaflet prepared by the American Sales Corporation of Pittsburgh, Pa.

SECOND - HAND MATERIAL. — The Walter A. Zelnicker Supply Company of St. Louis has issued a bulletin, No. 230, in which is listed its material on hand for immediate delivery.

RAILWAY DATA.—The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., is distributing Vol. 1, No. 3, of "Railway Engineering Data." A reprint from the *Electric Journal* on "Problems Confronting the Electric Railway Industry" is also being distributed.

HEAT REGULATOR. — The Western Electric Company of New York has prepared a folder in which is described the new heat regulator recently offered to the trade. This circular points out the prominent features of this device, how the contractor can sell it, what it does and how it works.

HEATING DEVICES. — The Simplex Electric Heating Company of Cambridge, Mass., has prepared eighteen bulletins, inserted in one folder, in which are described and illustrated the heating devices of this company. The devices described are soldering irons, household devices, glue pots, baking ovens, water heaters, hotel appliances, immersion coils, disk stoves, fry kettles, ranges, radiators, hot closets, laundry and tailor equipment and instrument sterilizers.

SPACE HEATER UNIT AND AIR HEATER.—Two small six-page circulars have just been published by the Cutler-Hammer Manufacturing Company of Milwaukee. One folder is entitled, "C-H Electric Space Heater Unit" and describes a steel-jacketed unit which is approximately the size of a 2-ft. rule. The circular describes a number of applications of this unit, giving several suggested ways of mounting it. The circular also makes note of the fact that these heater units are now put up in standard packages of ten each, carrying a label at each end so that the boxes can be easily identified when carried on the shelves of the stockroom. The rating of each unit is 500 watts, and they may be used on either alternating-current or direct-current circuits. The other circular is entitled, "C-H Electric Air Heaters." These heaters are divided into a number of groups, several being for industrial or mill use, made with ratings of from 2 kw. to 10 kw. Other heaters are illustrated and are particularly desirable for offices, bedrooms, bathrooms, etc., and have a better appearance than the mill or industrial type of heater. The dimensions, ratings and prices are given in the folder.

New Incorporations

THE ROCK RIVER POWER COMPANY of Watertown, Wis., has been chartered with a capital stock of $5,000 by George E. Manshot, A. M. Keniston and Pulius Podolski.

THE DAVISON ELECTRIC COMPANY of Tulsa, Okla., has been incorporated by Frank S. Davison, Jay Collis and James E. Hotham of Tulsa. The company is capitalized at $10,000.

THE AJAX ELECTRIC COMPANY of Jersey City, N. J., has been incorporated with a capital stock of $100,000 by W. C. Banks, H. Shippen and D. C. Roberts, all of Hoboken, N. J.

THE TIDEMAN ELECTRIC MANUFACTURING COMPANY of Cairo, Ill., has been chartered with a capital stock of $650,000 by Henry Tideman, Charles M. Roos and James H. Galligan.

THE DIX-KELLY ELECTRIC SHOP of Fort Wayne, Ind., has been incorporated by Robert E. Kelly and Frank Dix. The company will do a general electrical service and supply business.

THE LUCKEY (Ohio) LIGHT & POWER COMPANY has been incorporated with a capital stock of $5,000 to generate and distribute electricity. The incorporators are: Chester C. Martin, George Welling, William Aspacher, William L. Hoelter and William H. Schwane.

THE R. I. ELECTRICAL INSTRUMENT COMPANY of Providence, R. I., has been incorporated by Claude R. Branch, Edson K. Smith and Herbert J. Humphrey of Providence. The company is capitalized at $50,000 and proposes to do a general manufacturing business.

THE WHITEWATER POWER & MINING COMPANY of Wilmington, Del., has been incorporated under the laws of the State of Delaware with a capital stock of $500,000. The company proposes to do a general mining business, distribution of power by steam, electricity, etc.

THE AMERICAN SYNDICATE OF INDUSTRIAL ENGINEERING of New York, N. Y., has been organized with a capital stock of $180,000 to do a general electrical engineering and contracting business. The incorporators are George V. Reilly, S. B. Howard and A. W. Britten, 65 Cedar Street, New York, N. Y.

THE AUTOMATIC ELECTRIC LIGHT COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $1,000,000 and proposes to manufacture electric lamps, globes, etc. The incorporators are: A. W. Britton, S. B. Howard, G. V. Reilly, all of New York, N. Y.

THE MESSER & ZUBER MANUFACTURING COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $200,000. The company proposes to manufacture automatic signal lamps for automobiles, etc. The incorporators are: S. N. Messer, L. F Zuber and F. J. Rooks of Brookville, Pa.

THE BRASSIE-BOWERS ELECTRIC COMPANY of Indianapolis, Ind., has been incorporated by Ralph E. Bowers, Lloyd M. Bowers and Ralph A. Brassie. The new company will take over the fixtures, merchandise and lease of the office at 637 Main Street of the Decker-Chadbourne Electric Company, which recently went into the hands of a receiver.

New England States

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company has purchased the water rights connected with the United States Bobbin & Shuttle Company, giving the company all the water privileges that are desirable from the mouth of the river in this city, where it empties into the Merrimac River and the village of Goffstown.

CHICOPEE, MASS.—The Turners Falls Power & Electric Company will install at once an additional 750-kw. motor-generator set at its local plant.

GREAT BARRINGTON, MASS.—The Great Barrington Electric Light Company has petitioned the State Gas and Electric Commission for an approval of an issue of $180,000 in capital stock to pay for additions and extensions to its plant and system.

GREAT BARRINGTON, MASS.—A joint petition has been presented to the State Gas and Electric Commission by the Great Barrington Electric Company, the Lenox (Mass.) Electric Company and the Stockbridge Lighting Company for approval of the consolidation of the three companies.

LEOMINSTER, MASS.—The City Council has accepted a contract with the Leominster Electric Light & Power Company for lighting the streets of the city. The contract provides for a franchise permitting the company to erect a transmission line through Florence, Howard, Lancaster and Litchfield Streets and Elm Hill Avenue, to connect a substation with its main line from Still River.

PALMER, MASS.—Plans have been filed by the Wright Wire Company for the construction of an addition to its local plant, for which contract has been awarded to the Eastern Bridge & Structural Company, 88 Crescent Street, Worcester.

STOCKBRIDGE, MASS.—The Stockbridge Lighting Company has applied to the State Gas and Electric Commission for permission to issue $8,500 in capital stock, the proceeds to be used for extensions and improvements to its plant.

TURNERS FALLS, MASS.—During the present year the Turners Falls Power & Electric Company will put into operation a new station, known as the Hampden station (steam generating), which will be equipped with eight 652-hp. Edge Moor boilers, two 15,000-kw., 13,200-volt, three-phase, 60-cycle turbines, six (two banks) 6250-kva., single-phase, 66,000/13,200-volt Westinghouse transformers, and H-6 and KO-26 oil switches.

WOBURN, MASS.—The City Council is considering compelling the Edison Electric Illuminating Company to place its wires underground on part of Main Street.

Middle Atlantic States

ALBANY, N. Y.—Three bills have been introduced in the State Legislature by Senator Gibbs of Buffalo, providing for the construction by the State of a hydro-electric plant on Goat Island, Niagara Falls, to develop 50,000 hp. If the measure should be approved by the voters, provision would be made for a bond issue of $3,000,000. Under the terms of the proposed bill the plant would be operated either under the management of the State or by lease.

BROOKLYN, N. Y.—Plans are being prepared by the Interborough Rapid Transit Company, 165 Broadway, New York City, for the erection of a one-story transformer station, 50 ft. by 100 ft., on Livonia Avenue, near Rockaway Avenue, Brooklyn, to cost about $40,000.

ELMIRA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Feb. 14, for installing a conduit and lighting system in the United States post office at Elmira, N. Y. Drawings and specifications may be obtained at the above office or at the office of the custodian at Elmira.

MECHANICSVILLE, N. Y.—The City Council has authorized the commissioner of public works to prepare specifications for bids for lighting the streets and public buildings of the city of Mechanicsville, to be opened not later than Jan. 28. Two forms of bids are to be submitted, one for a straight five-year contract from Feb. 1, 1918 to Feb. 1, 1923, the other to be subject to cancellation at any yearly period after Feb. 1, 1919.

MIDDLEPORT, N. Y.—The capital stock of the Middleport Gas & Electric Company has been increased from $30,000 to $50,000.

OGDENSBURG, N. Y.—The Oswegatchie Light & Power Company of Gouverneur, it is reported, is contemplating extending its electric transmission line into Ogdensburg to furnish electricity here.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way.

SCHENECTADY, N. Y.—J. C. Aitkin, 216 South Centre Street, is contemplating the construction of an extension (one story) 50 ft. by 80 ft., to his storage battery works.

SPRINGVILLE, N. Y.—Power lines of the municipal electric-light plant will be entirely rebuilt this summer. About 2 miles of line has been completed and probably as much more will be erected during this year.

UTICA, N. Y.—Plans have been filed by the Utica Steam & Mohawk Valley Cotton Mills, 1000 Broad Street, for the construction of an addition to its power plant, 30 ft. by 70 ft., one-story, to cost about $11,000. Contract has been awarded to George Hopp, 1022 Seymour Street, Utica.

BURLINGTON, N. J.—A section of the power plant and laundry building of the Masonic Home, located outside of the city limits, was destroyed by fire on Jan. 14, causing a loss of about $12,000.

JERSEY CITY, N. J.—Plans have been filed by the Public Service Electric Company for an addition to its plant at the foot of Duffield Avenue, to cost about $4,000.

JERSEY CITY, N. J.—A bill has been introduced in the Legislature providing for an issue of $150,000 in bonds for the proposed improvements and extensions to the Hudson County electric plant, to enable the plant to furnish electricity for lighting the county institutions, streets, etc.

KENILWORTH, N. J.—The Borough Council has voted to enter into a contract with the Public Service Electric Company for lighting the streets of the borough. The contract calls for 58 lamps.

KEYPORT, N. J.—Application has been made to the City Council by the New York Telephone Company for permission to install new underground conduits in a number of additional streets in the city.

LAMBERTVILLE, N. J.—The Lambertville Public Service Company has announced that, due to the shortage of coal, the electric street-lighting system will not be operated until further notice.

LODI, N. J.—Bids will be received by the Mayor and the Borough Council until Feb. 11 for the construction of an auxiliary pumping plant and extension to the water distributing system, consisting of brick structure and chimney, boiler, feed pump, etc., and cast-iron pipe. Copies of plans and specifications may be obtained from Thomas F. Bowe, consulting engineer, Association Building, Rutherford, N. J., or 95 William Street, New York, N. Y., upon deposit of $15, of which $12 will be refunded.

TRENTON, N. J.—The Public Service Corporation has announced that all arrangements have been perfected for the early installation of an electrolysis mitigation system.

HARRISBURG, PA.—The Harrisburg Light & Power Company is contemplating the installation of four new stokers at its plant in connection with the proposed improvements. C. M. Kaltwasser is general manager.

KUTZTOWN, PA.—The Borough Council is considering calling an election to submit the proposal to appropriate $15,000 for the completion of the municipal electric-light plant.

SCRANTON, PA.—Plans have been prepared for the erection of the Johnson School, Richmond Hill, Scranton, a three-story school building, 40 ft. by 160 ft., to be used for manual training work. Fred Nelson, Connell Building, is architect.

BALTIMORE, MD.—Contract has been awarded by the Consolidated Gas, Electric Light & Power Company to the Cowan Building Company; 106 West Madison Street, Baltimore, for the construction of a substation on Post Office Avenue.

MARLINGTON, W. VA.—The municipal electric-light and water plant was recently destroyed by fire, leaving the city without electrical service. The plant, it is understood, will be rebuilt. Frank King is manager.

SWITCHBACK, W. VA.—The central power plant of the Appalachian Power Company, which has been supplying electricity to approximately 81 mines in the Pocohontas and New River coal fields was recently destroyed by fire. The company, it is understood, will rebuild the plant immediately.

WASHINGTON, D. C.—The erection of a three-story building on F Street near Seventeenth Street has been authorized by the War Department for use of telephone system of the department. A. D. Scovel will be in charge of the service.

WASHINGTON, D. C.—Bids will be received by the United States Reclamation Service, Department of the Interior, Washington, D. C., until Feb. 5 for furnishing electrically-operated drag-line excavators for the North Platte, Neb., project.

WASHINGTON, D. C.—Bids will be received at the office of the chief of Bureau of Yards and Docks, Washington, D. C., until Feb. 11 for furnishing under specification (2786) electrically-driven capstans at the Norfolk and Philadelphia navy yards. The cost is estimated at $110,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: Brooklyn, N. Y., Schedule 1665—Miscellaneous plain interior-communication cable; Schedule 1664—15,000 ft. single-stranded, rubber-covered wire. Puget Sound, Wash., Schedule 1663—16,000 ft. single-conductor lighting and power wire, 13,000 ft. two-conductor lighting and power wire.

North Central States

DETROIT, MICH.—A permit has been granted to Esselstyn, Murphy & Hanford to erect a power house on Livernois Avenue for the Lincoln Motor Company, to cost about $100,000.

EATON RAPIDS, MICH.—At an election held Dec. 31 the proposal to issue $30,000 in bonds for the purchase of the water power at Eaton Rapids and Smithville on the Grand River, 2 miles distant, was defeated. This is the second time the voters have defeated the bond issue.

MARQUETTE, MICH. — Arrangements have been made by the City Commission to employ an engineer to prepare plans and estimates for the construction of an addition to the hydroelectric power plant on Dead River, to cost approximately $75,000. Charles Retallic is superintendent of the municipal light and power plant.

PIQUA, OHIO.—Owing to the request of the government to conserve fuel, Mason H. Lytle, local manager of the Dayton Power & Light Company, has asked the City Council either to revoke or hold the contract on file for the proposed ornamental lighting system in Piqua until conditions are changed.

YOUNGSTOWN, OHIO.—The Ohio Public Utilities Commission has granted the Mahoning & Shenango Railway & Light Company permission to issue $2,000,000 in bonds, the proceeds to be used for improvements to be made to its system during 1918.

HODGENVILLE, KY. — The Hodgenville Lighting Company is planning to install an ice plant this spring. C. L. Herrin is president.

MAYFIELD, KY.—The water and light plants of the Mayfield Water & Light Company have been purchased by the city of Mayfield, which will take over the property March 31. C. A. Orr is superintendent of the Mayfield company.

STURGIS, KY.—The Sturgis Electric Light Company has recently installed a 200-kw. Westinghouse synchronous motor-generator set, 2200 volts, alternating current, 250 volts, direct current. Sherman Melton is electrical engineer.

WHITESBURG, KY.—The Kentucky River Power Company of Hazard is contemplating extending its electric transmission line from Hazard to Whitesburg.

AKRON, IND.—The Akron Light, Heat & Power Company is contemplating building an automobile storage battery charging and repair station. Karl B. Gast is secretary.

AURORA, IND.—The Indiana Public Service Company has erected 9 miles of 33,000-volt transmission line to connect with the line now being erected by the Union Gas & Electric Company of Cincinnati. The company expects to purchase energy for its system in Aurora and close down the local plant. C. B. Hanna is manager.

GARY, IND.—The Gary Heat, Light & Water Company, controlled by the United States Steel Corporation, is building a new 300-kw. substation and transmission line. F. W. Van Sise is superintendent.

HOPE, IND.—Improvements are contemplated to the Pulse & Porter electric-light plant, including resetting boilers, repairing engines, installing Fairbanks-Morse oil engine and remodeling the plant throughout. Will Porter is manager.

MARION, IND.—The Marion Lighting & Heating Company contemplates enlarging its plant during 1918. O. M. Drischel is general manager.

ORLAND, IND.—The Orland Light & Power Company expects to establish an 18-hour service in the near future and to erect some rural transmission lines this summer, and also to improve the water power to its highest efficiency as soon as possible. L. W. Jacob is owner.

ZIONSVILLE, IND.—The motor in the power house of the Zionsville Water & Electric Light Company was recently burned out, leaving the town without electrical service.

CHESTER, ILL.—The office and salesrooms of the Saline Electric Company were recently destroyed by fire.

CULLOM, ILL.—The Cullom Electric Company is rebuilding all its distribution lines, on which work is about one-half completed. A. G. Walter is manager.

MATTOON, ILL.—The Central Illinois Public Service Company has petitioned the Public Utilities Commission for authority to issue $500,000 in bonds.

PRINCETON, ILL.—The City Council is considering the purchase of an additional generating unit for the municipal electric-light plant or buying energy from the hydroelectric plant at Marseilles. Clarence Anderson is city clerk.

VERMILION, ILL.—The Town Board is considering the advisability of granting an extension of the lighting franchise of the Terre Haute, Indianapolis & Western Traction Company which has expired.

AKELEY, MINN.—The Cuyuna Range Power Company is installing a 200-kw. three-phase, 60-cycle generator connected to a cross compound, condensing Corliss engine. When improvements are completed (about May 1) the company will establish a 24-hour service in both Akeley and Walker. Series 6.6-amp. lamps will be used for street lighting. M. D. Stoner is president and manager.

BRAINERD, MINN.—The City Council contemplates a new water supply this season, including a new pumping station and equipment and laying approximately 14 miles of new water mains. William Nelson is secretary of water and light board.

GLENWOOD, MINN.—The Glenwood Electric Light, Heat & Power Company is planning to extend its high-tension transmission line to Cyrus this year. E. O. Burow is superintendent.

HAWLEY, MINN.—The city of Hawley has a two-year contract with the Hawley Milling Company to furnish energy to operate the municipal electric-light plant. At the termination of the contract the city will probably install a steam plant. J. P. Roach is superintendent.

KEEWATIN, MINN.—Plans are being considered for replacing the arc lamps on three city blocks with an incandescent system, using type "C" lamps. A. Bodoh is superintendent of the municipal electric-light plant.

MAYNARD, MINN.—The transmission lines of the municipal electric-light system are being extended within the village limits furnishing electrical service to farmers along the lines. Lawrence A. Sanner is manager.

NEW PRAGUE, MINN.—Improvements are contemplated to the municipal electric-light plant, including the construction of a 100-ft. chimney, 40 in. in diameter at the top, one 80,000-gal. steel water tank to be built on the present tower, which is 80 ft. high. Joseph T. Rynda is superintendent.

BRITT, IOWA.—The Britt Light & Power Company contemplates the purchase of a 100-hp. horizontal return tubular boiler during 1918. L. M. Goodman is president.

DANBURY, IOWA.—The Durst Light & Power Company is considering extending its electric transmission lines toward Mapleton this summer. Mark Durst is manager.

DES MOINES, IOWA.—Bids will be received by the city of Des Moines until Feb. 13 for the construction of a municipal building, including steam heating, electric wiring, one electric passenger elevator, vacuum cleaner, plumbing, etc. The building will be 83 ft. by 172 ft., three stories and basement, and will cost about $350,000. Frank Jeffries is city clerk.

EARLHAM, IOWA.—The town officials are considering the extension of the municipal electric transmission lines into the farming sections and will require equipment, including poles, wire, transformers, etc. M. A. Thorp is superintedent.

EARLING, IOWA.—The Stinn Implement Company is erecting an electric transmission line into the country, 5 miles out, and will furnish electrical service to country residences in the spring. The company has recently completed a new power station and the erection of an electric transmission line to Westphalia, a distance of 5½ miles. A. C. Stinn is manager.

HAWARDEN, IOWA. — The municipal electric-light plant was recently damaged by a loose flywheel, causing a loss of about $4,000.

SIOUX CITY, IOWA.—The city clerk has been authorized to ask for bids for an air-lift pumping system for the Main Street pumping station, consisting of nine air-lift pumps, booster, piping, air compressors, engines, etc. The cost is estimated at about $50,000.

WINTERSET, IOWA. — Improvements will be made to the municipal electric-light plant, including the installation of a 150-hp. boiler and the erection of a smokestack 125 ft. high. L. O. Klein is manager.

KANSAS CITY, MO.—Initial steps have been taken by the Kansas City Light & Power Company for the construction of its proposed power plant on the Missouri River at the foot of Brooklyn Avenue. The present plans provide for an ultimate generating capacity of 150,000 kw., which with the necessary distributing lines will cost approximately $15,000,000. The initial installation will consist of two turbines with a rating of 25,000 kw. each and will cost about $5,220,000. Two intake pipes will be built, each of which will supply the condensers with 200,000 gal. per minute. Each turbine will be equipped with a condenser.

ST. LOUIS, MO.—Contract, it is reported, has been awarded by the Wagner Electric Manufacturing Company for the erection of a new plant, 130 ft. by 500 ft., one story.

ST. LOUIS, MO.—The Union Electric Light & Power Company has applied to the Public Service Commission for permission to issue $1,500,000 in bonds and $1,000,000 in additional capital stock.

ST. LOUIS, MO.—Plans are being considered by the St. Louis Malleable Castings Company, Conduit Avenue, for the construction of a new plant, consisting of a machine shop, forge shop, foundry, electric power plant and other buildings. The cost is estimated at $50,000.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, St. Louis, until Jan. 29 for the installation of four 425-hp., Heine type, water tube boilers, eight automatic chain grates and stokers, coal and ash-handling machinery, erection of brick and concrete stack, 250 ft., with smoke flue connections. Plans and specifications may be obtained at the office of E. E. Wall, water commissioner.

WELLSVILLE, MO.—The electric plant of the Blattant Poultry & Manufacturing Company was recently destroyed by fire. The company also supplied electricity in the town.

BAYARD, NEB.—Bonds to the amount of $5,500 have been authorized for the installation of a lighting system.

MURRAY, NEB.—The City Council has contracted with the Nebraska City (Neb.) Utilities Company to furnish electricity for commercial purposes for city distribution system.

ASHLAND, KAN.—New equipment, consisting of an 80-kw., three-phase, 60-cycle, 2300-volt generator and a 100-hp. De La Vergne gas engine is being installed in the municipal electric-light plant. O. M. Chinn is superintendent.

BELOIT, KAN.—Improvements are being made to the municipal light and water plant, including the installation of a new filtration plant and erection of an addition to power house. A Custodis radial brick chimney has recently been completed and a 150-hp. boiler installed. New pumping machinery, which has been ordered, will soon be installed. F. A. Darst is superintendent.

CANEY, KAN.—The Kansas Light & Power Company, which recently took over the local plant, contemplates building a new plant this spring. Steam power will probably be used. L. R. MacConnell is president and general manager.

DIGHTON, KAN.—At an election to be held Feb. 4 the proposal to issue $10,000 in bonds for extensions to the municipal water and light plant will be submitted to the voters.

GARDEN CITY, KAN.—Improvements are being made to the municipal electric-lighting system, including the erection of 1½ miles of power line; installing one 50-hp. and two 25-hp., 2300-volt motors and pumps, to pump the city water. S. E. Austin is superintendent.

GYPSUM, KAN.—The Central Kansas Power Company is extending its electrical service to Kipp. J. F. Keys is secretary and manager.

LINCOLN, KAN.—The City Council is considering the installation of a 250-hp. Diesel engine-driven unit in the municipal light and water plant soon. A. W. Seng is superintendent.

McPHERSON, KAN.—New equipment, including a 312-kva. generating unit, directly connected, driven by a Skinner uniflow engine and a Union Iron Works 250-hp. water tube boiler is being installed in the municipal electric-light plant. C. F. Rasmussen is superintendent.

NESS CITY, KAN.—The installation of a new 100-hp. Snow oil engine in the municipal electric-light plant is under consideration. A 24-hour service will be established about March 1. Claude Baker is superintendent.

WILSON, KAN.—The town officials are considering taking over the plant of the Wilson Electric Light Company and consolidating it with the municipal electric-light plant.

Southern States

RALEIGH, N. C.—The installation of an additional 200-hp. boiler in the steam heating plant of the North Carolina State College of Agriculture and Engineering is under consideration.

ATLANTA, GA.—The United States government has definitely decided to locate a repair shop at Atlanta, Ga., to cost about $2,000,000. The Mackle Construction Company of Atlanta will build the plant. Col. Stayer, Forsythe Building, is in command.

PENSACOLA, FLA.—The Pensacola Electric Company is contemplating the erection of a 13,200-volt transmission line to the Pensacola naval station. Thomas J. Hanlon, Jr., is manager.

ALEXANDER CITY, ALA.—At an election to be held Jan. 21 the proposal to issue $10,000 in bonds for extensions to the municipal electric-light plant will be submitted to the voters.

ATMORE, ALA.—The W. M. Carney Mill Company is contemplating the installation of a 10-ton ice plant, to be operated in connection with the electric plant. Ward Converse is manager of the electrical department of the company.

FOLEY, ALA.—Bonds to the amount of $3,000 have been voted to build or purchase an electric-light plant.

SOUTH FLORENCE, ALA.—Plans have been prepared by the War Department for the construction of another dam (No. 2) at Muscle Shoals on the Tennessee River, 5 miles from Florence. The plans include a hydroelectric development, the erection of electric transmission lines, etc., to cost approximately $13,500,000. This development is for the purpose of furnishing electricity to operate the proposed $30,000,000 ammonium nitrates plant of the government. Contract for dam has been awarded to the J. G. White Engineering Company, 43 Exchange Place, New York, N. Y. M. T. Thompson and P. J. Davis, resident superintendents, South Florence.

CANTON, MISS.—The installation of a surface condenser for a 200-hp. engine and spray equipment for cooling in the municipal electric-light plant is under consideration. John T. Sharp, Jr., is manager.

CLARKSDALE, MISS.—The Water and Light Commissioners contemplate the installation of a 1000-hp. water-tube boiler and a 1000-kw. turbo-generator; boring now a 13-in. well furnishing 1000 gal. per minute, equipped with a motor-driven Layne pump. W. W. Pointer is superintendent.

CLEVELAND, MISS.—The Home Light & Ice Company contemplates installing a 75-hp. boiler this spring. E. J. Nott is president.

GREENWOOD. MISS.—Estimates are now being secured by the Light and Water Works Commissioners on a turbine and centrifugal pumps. Roy Stott is manager.

HOUSTON, MISS.—The city of Houston expects to install a new plant complete. The equipment will consist of an 80-hp. crude oil engine, directly connected to a 60-kva., three-phase, 2300-volt, revolving field motor and switchboard. A. G. Atkinson is superintendent.

POPLARVILLE, MISS.—The municipal electric light plant and water works system has been leased to the Poplarville Light & Water Company. New equipment, including a 60-hp. Remington oil engine and a 10 by 12-in. Chicago Pneumatic Tool Company compressor, is being installed in the plant. Crude oil and distillate will be used as fuel. F. F. Kidwell is manager.

WIGGINS, MISS.—The City Council is contemplating improvements to the electric-lighting and water-works systems.

BLYTHEVILLE, ARK.—The Missouri & Southeastern Utilities Company contemplates replacing all 16-cp. street lamps with

100-cp. lamps. J. G. Fisher is superintendent.

HOPE, ARK.—The installation of crude oil engines in the municipal electric-light plant is under consideration. Charles M. Richards is manager.

DE RIDDER, LA.—Orders have been placed by the De Ridder Light & Power Company for a 150-kva. General Electric generator to be directly connected to a 16-in. by 16-in. Corliss-Ball engine. The company has been granted a 25-year franchise. W. F. McCammon is secretary.

DONALDSONVILLE, LA.—The Water and Light Commission is building reservoirs and drilling deep wells for the water supply. J. W. Byrnes is manager.

NEW IBERIA, LA.—Improvements contemplated by the City Council this year include the installation of an ornamental-lighting system and the purchase of oil engines for the municipal electric-light plant. Lawrence F. Villermin is manager.

NEW ROADS, LA.—Improvements are contemplated to the municipal electric-light plant in the near future, consisting of the installation of a crude-oil engine to replace steam power and drilling a deep well. R. Vignes is superintendent.

BARTLESVILLE, OKLA.—The Crystal Ice & Storage Company is planning to rebuild its plant soon, which was destroyed by fire some time ago. The new plant will have three times the capacity of the old one.

CANADIAN, OKLA.—The City Council is considering calling an election soon to submit the proposal to issue bonds for the installation of an electric-lighting plant and water works system.

MIAMI, OKLA.—The capital stock of the Empire District Electric Company of Oklahoma has been increased from $30,000 to $200,000. The company is controlled by the Empire District Electric Company of Missouri.

PRAGUE, OKLA.—The City Council contemplates calling an election to vote on the proposal to issue bonds for improvements to the municipal electric-lighting system.

SEMINOLE, OKLA.—Bids, it is reported, will be received by the city of Seminole until Feb. 4 for the construction of an electric-light plant. L. M. Hammon is city clerk.

TULSA, OKLA.—Plans have been prepared by the Southwestern Bell Telephone Company for the construction of an addition to its telephone exchange building at Fourth and Boston Streets, to cost about $75,000.

AUSTIN, TEX.—The Austin Power Company (Guy A. Collett, receiver), it is reported, will petition the Federal Court for permission to repair the Austin dam. The cost is estimated at about $100,000.

DALLAS, TEX.—The contract providing for the exchange of power between the Dallas Power & Light Company and the Texas Power & Light Company has been approved by the City Commission. The contract as originally submitted to the supervisor of utilities called for an expenditure of $350,000 for transmission lines and transforming apparatus, but concessions have been made which will save the local company a total of $130,000. The contract covers the purchase of 3000 kw. with an increase to 5000 kw. Under the agreement the Dallas company will furnish energy to the Dallas Railway Company for the Oak Cliff and East Dallas lines, which is now supplied by the Northern Texas Traction Company.

DENISON, TEX.—The Texas Electric Railway Company is planning to erect a passenger station and repair shop.

TEXARKANA, ARK.-TEX.—Bids will be received in duplicate, one addressed to J. H. McLain, secretary of board of public affairs, Texarkana, Ark., and one to W. J. DeFee, city secretary, Texarkana, Tex., until Feb. 5, for the construction of a joint sewage disposal plant, consisting of two settling tanks, two sprinkling filters, two sludge beds, two pumping stations, together with necessary appurtenances. Plans, specifications, bidding blank may be obtained on application to L. T. Peden, consulting engineer, 2204 Chartres Street, Houston, Tex.

Pacific and Mountain States

CHEHALIS, WASH.—O. E. Anderson has petitioned the City Council for a franchise to supply electricity for lamps and motors in Chehalis for a period of 30 years. The ordinance has been given its first reading and provides for the installation of the new plant within nine months after the franchise is granted.

DAVENPORT, WASH. — Preliminary work is being done by the Inter-Mountain Power Company toward the immediate erection of a high-tension transmission line from the Long Lake plant of the Washington Water Power Company in the northeast corner of Lincoln County to the Milwaukee Railway, at a point about 12 miles south of Odessa. The Inter-Mountain company has the contract for furnishing energy to the Milwaukee Railway for operating its lines between Othello and Puget Sound cities.

PORT ANGELES, WASH.—The Paraffine Companies, Inc., of Port Angeles, which are constructing the Crescent Card factory, at a cost of $200,000, have announced that the plant will be operated entirely by electricity, supplied by the Washington Power & Manufacturing Company from its plant located on the Elwha River, 7 miles from Port Angeles.

SEATTLE, WASH.—A permit has been granted to the Erickson Shipbuilding Company, 4200 Iowa Avenue, for the erection of a power house, to cost about $5,000.

SEATTLE, WASH.—Specifications submitted by J. D. Ross, superintendent of lighting, for incandescent lamps for the year 1918, have been approved by the Board of Public Works. Approximately 500,000 lamps will be purchased this year.

SEATTLE, WASH.—The Board of Public Works has approved the revised specifications submitted by J. D. Ross, superintendent of lighting, for the development by the city of Seattle of the Diablo Canyon power project on the Skagit River, which call for separate bids, instead of a lump sum for the plant and transmission lines. The original ordinance has been amended and now authorizes an expenditure of $5,000,000 instead of $3,000,000, and confines the plant to federal domain. The transmission lines have been changed from steel tower construction to wooden pole lines. The date for opening bids for the construction of the $5,000,000 hydroelectric plant has been set for March 5 by the Board of Public Works.

NORTH BEND, ORE.—The Oregon Power Company is negotiating with the City Council relative to replacing the arc lamps now in use with 100 and 60-watt lamps, which would be extended over the intersections on 8-ft. arms.

SALEM, ORE.—The Mountain States Power Company, organized under the laws of the State of Delaware, has received a permit to operate in Oregon. The company is capitalized at $5,000,000. Richard Shore Smith of Eugene is representative for this state. The main offices of the company are located in Wilmington, Del.

DURHAM, CAL.—The Durham Light & Power Company is contemplating the installation of a distribution system in about 60 days. J. A. Foster is owner and manager.

GLENDALE, CAL.—Negotiations are under way with the Southern California Edison Company to purchase the Edison system in Tropico and merge with the Glendale system. Tropico has consolidated with Glendale.

LOMPOC, CAL.—The Continental Securities Company, which controls the Lompoc Light & Power Company, has submitted a proposal to the Board of City Trustees offering to sell the property to the city for $30,000.

LOS ANGELES, CAL.—Additions are being erected to the local shops of the Los Angeles, San Pedro & Salt Lake Railroad Company, consisting of a new pattern shop and structures for coach, engine and tank car repair work. The cost is estimated at about $100,000.

PALO ALTO, CAL.—At an election held Jan. 5, bonds to the amount of $66,000 were voted for improvements to the electric-light plant, including the installation of a 500-hp. Diesel engine and a 350-kw. (approximately) electric generator, for which contract will be awarded at once. Frank Kasson is city clerk.

QUINCY, CAL.—The Quincy Electric Light & Power Company is contemplating the purchase of an engine before the next low-water period, to be used as an auxiliary to water power. A. L. and O. P. Payne are managers.

SAN BERNARDINO, CAL.—The construction of a new hydroelectric power plant in Little Bear Valley is under consideration by the Arrowhead Reservoir & Power Company. The plans provide for an initial development of 12,000 hp., to cost about $2,000,000.

BONNERS FERRY, IDAHO.—The Bonner Water & Light Company contemplates the installation of a Rumsey triplex 375-gal. per minute pump. F. T. Berger is manager.

BOVILL, IDAHO.—Bonds to the amount of $5,500 have been voted for the installation of a municipal electric-lighting plant. The proposed plant will be installed in the pumping station in which an engine and other necessary equipment will be placed.

JULESBURG, COL.—The Council expects to build a new electric-light plant within the next two years. J. R. Aldrich is superintendent.

MEAD, COL.—The Supply Irrigating Company is reported to be considering the construction of a reservoir in connection with an irrigation project, to cost about $250,000.

SALIDA, COL.—The Colorado Power Company, it is reported, is contemplating doubling the output of its local plant.

SILVERTON, COL.—Arrangements are being made by the Silverton Electric Light Company for replacing the arc lamps now in use with type "C" nitrogen lamps of 250 cp. Material has already been purchased.

STERLING, COL.—The distributing lines of the municipal electric-light plant are being rebuilt and extended into the suburbs. C. H. Love is assistant superintendent.

WRAY, COL.—The Wray Electric Light & Power Company is contemplating pumping water for the town, using two motors of 15 hp. each, and erecting a transmission line on the country road, about 3 miles, to furnish electrical service to the farmers. The company is now completing the installation of a 140-hp. boiler. M. Williams is owner.

Canada

CALGARY, ALTA.—Bids, it is reported, will be received by the Alberta Hydro-Electric Company of Calgary for the construction of a series of dams for power development along the Bow River. Z. Malholt, box 1480, Calgary, is consulting engineer.

NIAGARA FALLS, ONT. — Contracts have been awarded by the Hydro-Electric Commission of Ontario for the construction of a 13½-ft. wood-stave flume with turbines and generators for the development of 50,000 hp. (additional) at the plant of the Ontario Power Company. Of this 20,000 hp. will be available in August and the remainder in October.

OTTAWA, ONT.—Bids will be received by John A. Pearson, architect, and J. O. Marchand, associate, Centre Block, Parliament Buildings, Ottawa, until Feb. 5 for elevators and hoist equipment required in the reconstruction of the Parliament Building. Plans and specifications can be obtained at the office of P. Lyall & Sons Construction Company, general contractor, Ottawa.

Miscellaneous

PEARL HARBOR, HAWAII.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for construction of a combined post exchange and gymnasium, 50 ft. by 90 ft., and quartermaster's storehouse building, 40 ft. by 94 ft., including the installation of all conduits, wiring, cables, fixtures, necessary for a complete lighting and power system, plumbing, etc. Drawings and specifications (No. 2758) may be obtained upon application to the above bureau or to the commandant of the naval station named.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Feb. 11, for furnishing steel pipe, transformers, meters, copper cable and wire, conduit, electrical fixtures, slate, brass stuffing boxes, red lead, tackle blocks, etc. Blanks and information relating to this circular (1196) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

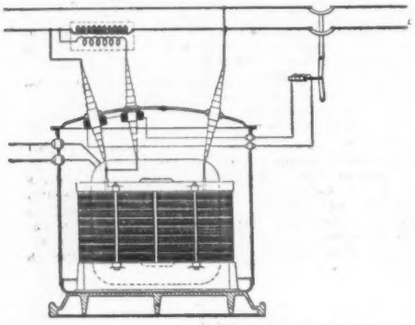
MANILA, P. I.—Extensive improvements are contemplated to the power plant and street railway system of the Manila Electric Railroad & Light Company, involving an expenditure of $4,000,000 during the next five years. The proposed plans include the installation of an additional 5000-kw. turbo-generator and other special plant equipment, which will increase the generating capacity of the plant approximately 50 per cent; the construction of new tracks and new track terminals and the reconstruction of old tracks; reconstruction of the overhead trolley system, building 15 new cars and rebuilding old cars, erection of new and additional electric light and power lines and the re-arranging and improving existing lines. The company has decided to enlarge the present steam plant instead of developing a water power on the Caliraya River. The plant is operated by the J. G. White Management Corporation, 43 Exchange Place, New York, N. Y.

(Issued Jan. 1, 1918.)

1,251,464. Transmission-Line Connector; Robert A. Becker, Poughkeepsie, N. Y. App. filed Nov. 27, 1916. Improvements.

1,251,473. Wireless Telegraphy; William M. Bruce, Jr., Springfield, Ohio. App. filed Dec. 8, 1915. Provides means whereby the signals which are usually received on a telephone receiver can be relayed to an ordinary telegraph instrument, such as a sounder or recording device.

1,251,475. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 13, 1916. Apparatus for



1,251,738—Protective System for Transformers

making peg counts in an automatic exchange.

1,251,479. Car-Lighting System; John L. Creveling, New York, N. Y. App. filed Aug. 7, 1911. Generator may be automatically governed.

1,251,495. Impulse-Sending Mechanism; Oscar F. Forsberg, Yonkers, N. Y. App. filed July 19, 1917. Specially adapted to be set into a wall set or into an operator's keyboard so that it will be flush with the surface of the wall set or the keyboard and thereby a smooth, even surface may be procured.

1,251,503. Two-Wire Multiple Automatic System; Charles L. Goodrum, New York, N. Y. App. filed June 21, 1915. Provision of a controlling relay or relays common to a group of lines which are arranged to control the operation of any one of a group of switches having access to the lines of the group.

1,251,543. Automatic Telephone System; Jacob W. Lattig, Glenside, Pa., and Charles L. Goodrum, New York, N. Y. App. filed April 25, 1916. System in which a calling subscriber can hold a connection which has been connected to a busy line, the talking strands of which are maintained open, and be atomatically connected to said line for conversation when it becomes idle.

1,251,544. Machine-Switching Telephone-Exchange System; Alen E. Lundell, New York, N. Y. Application filed April 26, 1916. Finder having a primary and secondary movement, a circuit arrangement is provided for extending the starter wire to the next wire finder upon the termination of the primary movement of such finder in seeking a calling line, instead of upon the termination of the secondary movement of such finder.

1,251,545. Telephone Switching System; Frank A. Lundquist, New York, N. Y. App. filed Nov. 15, 1916. Improvements.

1,251,562. Vacuum Regulation for Rectifiers; Harold A. Newcomb, Wilkinsburg, Pa. Improvements.

1,251,568. Electroplating Apparatus; Louis Potthoff, Flushing, N. Y. App. filed Dec. 14, 1916. Wherein a rotatable barrel supports the articles to be plated in the electrolyte.

1,251,569. Electroplating Apparatus; Louis Potthoff, Flushing, N. Y. App. filed May 12, 1917. Improvements.

1,251,572. Electrical Protective Apparatus; Charles S. Price, Rutherford, N. J. App. filed Nov. 13, 1916. Improvements.

1,251,578. Shaping Machine; William E. Riecken, N. Y. App. filed Nov. 1, 1916. Relates to the shaping of parts of solid conducting material, and more especially to the shaping thereof while heated to facilitate working.

1,251,594. Rheostat and Operating Means Therefor; William A. Turbayne, Niagara Falls, N. Y. App. filed Aug. 19, 1914. Variable resistance having operating means for bringing the resistance into operation under conditions which may be accurately predetermined.

Record of Electrical Patents

Notes on United States Patents

1,251,595. Generator-Regulator; William A Turbayne, Niagara Falls, N. Y. App. filed Nov. 23, 1912. For variable-speed generators which will maintain constant potential under wide ranges of speed.

1,251,596. Electropneumatic Brake; Walter V. Turner, Wilkinsburg, Pa. App. filed Dec. 6, 1916. Improvements.

1,251,604. Ringing Control System for Telephone Exchanges; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 28, 1915. Improvements.

1,251,618. Plug for Electric Conductors; Otto Bahls and Theodore Siebert, Jr., New York, N. Y. App. filed June 6, 1914. Improved plug and receptacle therefor.

1,251,628. Vapor Apparatus; Wilfred T. Birdsall, Montclair, N. J. App. filed May 4, 1915. Provides a cathode, in apparatus of the character specified, which has a low negative-electrode reluctance so as to be self-exciting.

1,251,637. Telephone-Exchange System; Warren W. Carpenter, Newark, N. J. App. filed Oct. 21, 1915 A register relay circuit for use in telephone-exchange systems of the semi-automatic type.

1,251,644. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. For recording calls.

1,251,645. Reversible Brush Holder for Use with Dynamos; John L. Creveling, New York, N. Y. App. filed Aug. 19, 1911. Improvements.

1,251,651. Core for Magnetic Coils; Lloyd Espenchied, Hollis, N. Y. App. filed Sept. 17, 1917. Loading coils and the like.

1,251,658. System of Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 25, 1914. Motor may be accelerated in a uniform and gradual manner, a plurality of efficient operating speeds may be obtained with the use of but few controlling switches, and sparking at the commutator may be obviated at all speeds.

1,251,659. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 23, 1915. Phase regulation.

1,251,660. Control System for Alternating-Current Motors; Rudolf Hellmund, Pittsburgh, Pa. App. filed Nov. 29, 1915. Substantially sparkless commutation.

1,251,665. Electric Riveting Tool; Leo Hirsh, Chillicothe, Mo. App. filed July 31, 1916. Provision of a riveting tool, including an impact-receiving riveting head operated by a plunger, which in turn is operated by co-operating solenoid coils, the plunger including a core common to both solenoids.

1,251,666. Municipal Traffic-Control System; James B. Hoge, Cleveland, Ohio. App. filed Sept. 22, 1913. Improvements.

1,251,669. Stroboscopic Device; Gunnar Jensen, Swissvale, Pa. App. filed Oct. 9, 1915. Used to determine the percentage slip of alternating-current dynamo-electric machines.

1,251,682. Door Releaser; Christian Miller, New York, N. Y. App. filed April 15, 1916. Improvements.

1,251,688. Control System for Flywheel Motors; John S. Peck, Altringham, and Siegmund Eckmann, Walley Range, England. App. filed Jan. 15, 1913. Improvements.

1,251,695. Cut-out Device for Telephone Transmitters; Leon E. Rennells, Albany, Ore. App. filed March 31, 1917. Improvements.

1,251,700. Shield for Magnetic Coils; Thomas Shaw, Hackensack, N. J. App. filed Sept. 17, 1917.

1,251,706. Automatic Regulator; William A Turbayne, Buffalo, N. Y. App. filed Sept. 25, 1912. Improvements.

1,251,707. Regulator for Electric Generators; William A. Turbayne, Niagara Falls, N. Y. App. filed April 20, 1914. Railway car lighting.

1,251,708. Regulator for Electric Generators; William A. Turbayne, Niagara Falls, N. Y. App. filed May 13, 1914. Improvements.

1,251,711. Starter for Internal-Combustion Engines; George R. Wadsworth. App. filed May 24, 1912. Motor vehicles.

1,251,728. Telephone-Exchange System; Frederick V. Young, Newark, N. J. App. filed Feb. 17, 1917. Prevents click in the answering operator's receiver.

1,251,738. Protective System for Transformers; Allan P. Bender, Wilkinsburg, Pa. App. filed Dec. 29, 1915. Improvement.

1,251,739. Electric-Lamp Socket; Reuben B. Benjamin, Chicago, Ill. App. filed Dec. 9, 1914. Rigid support.

1,251,750. Testing Arrangement; Henry P. Clausen, Mount Vernon, N. Y. App. filed July 24, 1916. Telephone.

1,251,751. Selective Switch; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. A reduction of the trunk-hunting interval.

1,251,752. Telephone; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. For facilitating the rapid hunting over a large number of contacts in the making of connections.

1,251,754. Lightning Arrester; Nicholas J. Conrad, Chicago, Ill. App. filed March 30, 1917. Horn-gap type.

1,251,762. Constant-Temperature-Recording Instrument; John W. Esterline, Indianapolis, Ind. App. filed June 8, 1916. Provides a heating coil which is controlled by a thermostate responsive to the temperature within such case, so as to maintain such temperature substantially constant.

1,251,764. Electric Welding; Charles H. Florandin and Alan M. Bennett, Westfield, N. J. App. filed Oct. 5, 1917. Arc.

1,251,768. Telephone-Exchange System; Charles L. Goodrum, Brooklyn, N. Y. App. filed Sept. 11, 1916. Makes it unnecessary to release a connection when the desired line at the connector is busy.

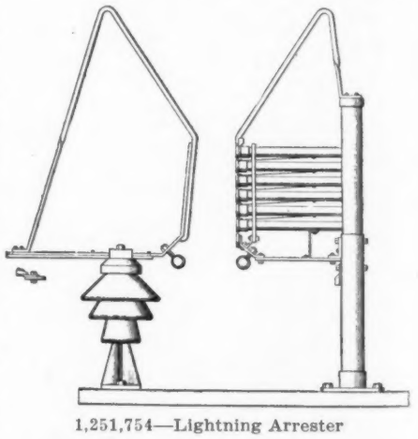
1,251,771. Electric Snap Switch; Monroe Guett, Hartford, Conn. App. filed Oct. 12, 1916. Improvements.

1,251,795. Selector Switch; Maurice K. McGrath, New York, N. Y. App. filed June 12, 1916. For use in automatic telephone systems.

1,251,797. Electrical Signaling System; J. L. McQuarrie, Montclair, N. J. App. filed Nov. 15, 1916. Code signaling in telephone-exchange systems.

1,251,825. Magnet Thermal Electric Light Flasher; Michael C. Ryan, Phoenix, N. Y. App. filed June 29, 1914. Automatic.

1,251,827. Brush for Electrical Machinery; Edmund O. Schweitzer, Chicago, Ill. App. filed Feb. 8, 1915. Improved



1,251,754—Lightning Arrester

brush and holder for securing a maximum bearing surface between the brush and the moving surface.

1,251,835. Brush-Raising Device; William Strutt, Pittsburgh, Pa. App. filed Dec. 18, 1914. Applies particularly to means for temporarily raising brushes out of engagement with the commutator cylinders thereof.

1,251,845. Brush-Holding Device; Lawrence W. Turnbull, Wilkinsburg, Pa. App. filed Nov. 6, 1914. Permits of relative adjustment of the pressures on opposite sides of the brush to prevent tilting thereof with its consequent bad results.